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ORIGINAL COMMUNICATIONS.

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[Reprinted from the 'Journal of the Asiatic Society' for May, 1849, with corrections by the Author.]

May 19*th*, 1848.—Left Darjiling in the forenoon of this day, accompanied by my friend C. Barnes, Esq. We took with us a small tent, about 15 Lepcha (Sikkim native) and Ghorkha (Nepal) coolies, with as few other servants as possible, these being bad mountaineers, and our route involving much ascent and descent. The direction is W.; the distance in a straight line little above 12 miles, but occupying good 3 days' march: for we have to descend from Darjiling 5000 feet to the intervening river beds, cross these and several spurs of 1000—1500 feet, and thence ascend to a summit 10,000 feet above the sea. The route is wholly within the Himalaya, and always through the forest region; large trees extending to the top of Tongló, which is below the lower limit of Alpine pines in this parallel, and of the Arctic vegetation of the loftier Himalaya.

A Lepcha carries his load in similarly formed, but much ruder baskets than those used by the Nepal races, and I observed that he uniformly used shoulder-straps, often without the belt across the forehead.* The weight thus transported to great distances

* May not the use of the head-strap be a predisposing cause of goître, by inducing congestion of the laryngeal vessels? The Lepcha is certainly far more free from this disease than the Bhotea, or than any of the tribes of E. Nepal I have mixed with, and he is both more idle and less addicted to the head-strap as a porter. I have seen it to be almost universal in some villages of Bhoteas, where the head-strap alone is used in carrying both summer and winter crops; and also amongst the salt-traders, or rather those families who carry salt from the passes to the Nepalese villages, and who have very frequently no shoulder-straps, but invariably head-bands. I am far from attributing all goître, even in the mountains, to this practice, but I think it is proved that the disease is most prevalent in the mountainous regions of both the old and new world, and that in these the practice of supporting enormous loads by the cervical muscles is frequent. It is also found in the Himalayan sheep and goats, which accompany the salt-traders, and whose burthens are supported, in ascending, by a band passing under the throat.

is very surprising: on an average our Lepcha loads weighed 100 to 120 lbs. On our return we had the curiosity to weigh the then sodden tent; it was 180 lbs., and had been carried for 10 hours both up and down hill in this state. To keep the contents of the basket dry, the Lepcha makes a large hood of bamboo platting, enclosing layers of leaves of *Phrynium dichotomum;* this fits over the head and basket, reaching as low as the hips, but is open in front, and leaves both the upper and lower limbs free.

In point of climate Tongló shares the excessive humidity of the rest of Sikkim, though when viewed from Darjiling it is often seen to be clear when all the northern and much nearer eastern and south-eastern mountains are wrapped in clouds. This arises from its position, and its partial protection from the S.E. or rainy wind. It rises as a long saddle, from a great southern spur of Kunchin-jinga, called Singalelah, which, dividing Nepal from Sikkim, extends from the perpetual snows of perhaps the loftiest mountain on the globe to the plains of India. The direction of this ridge is meridional. At right angles to Tongló, and a little south of it, the Sinchul ridge of 8000 feet meets that of Singalelah, the latter bounding Sikkim to the west, whilst the former shuts it off from the plains of India on the south. Darjiling station is on a ridge projecting N. from Sinchul, parallel to that of Tongló, which bounds the western horizon. Throughout the greater part of the year the S.S.E. wind prevails, rising at sunrise, and its vapours are at once condensed on the forests of Sinchul; billowy clouds rapidly succeed, and rolling over to the N. side of the mountain, are carried N.W., over a broad intervening valley, to Darjiling. There they bank on the east side of the spurs, and this being cleared of wood, the accumulation is slow,* and always first upon the few clumps of trees. Very generally by 9 A.M. the whole eastern sky, from the top of Darjiling ridge, is a dense fog, the western exposure enjoying sunshine for an hour or two later. At 7 or 8 A.M. very small patches are seen to collect on Tongló, which

* I have the singularly good fortune to occupy, in Mr. Hodgson's house, the most favourable spot in the station for watching the diurnal march of atmospheric phenomena. My host's house is placed on an eminence 500 feet above the main body of the Darjiling spur, and at its upper or southern extremity. It commands an unimpeded prospect to the N.W. and E., having Kunchin-jinga to the N., and the superb sweep of 80 miles of snow from its summit round by N.E. to E.: to the S.E. Sinchul; and to the W. the Singalelah range, from Kunchin to Tongló. The station stretches N. in front, as a sharp ridge. I have found it difficult to make old residents, on one or the other side of Darjiling spur, believe that whilst their house on the western slope is enjoying hours of sunshine, the whole eastern side is enveloped in fog.

gradually dilate and coalesce, but do not shroud the mountain for some hours, generally not before 11 A.M. or noon. Before that time, however, masses of mist have been rolling over Darjiling ridge to the westward, and gradually filling up the valleys, so that by noon or 1 P.M. every object is in cloud.

Towards sunset it falls calm, or a light S.W. wind springs up. In the former case the mists rise, first from the S.E. mountains, and especially if the S.E. wind, exhausted of its surplus vapours, still blows, which raises the clouds first from Sinchul; and when this is clear, Tongló breaks through the western mists. If on the other hand a S.W. breeze sets in, or a W. or N.W., Tongló clears first.

In descending from Darjiling the zones of vegetation are well marked at a little below 7000 feet, or between 6000 and 7000, by—(1.) The oak, chesnut, and *Magnoliaceæ*, the main features of 7000—10,000 feet. (2.) Immediately below 6500, the Tree-fern* appears (*Alsophila gigantea*, Wall.)—a widely distributed plant, common to the Himalaya from Nepal eastward to the Malayan Peninsula, Java, and Ceylon. (3.) Of palms, a species of *Calamus*,† and *Plectocomia*, the "Rhenoul" of the Lepchas. The latter, though not a very large plant, climbs lofty trees, and extends about 40 yards through the forest; 6500 feet is the upper limit of palms in the Sikkim Himalaya, the Rhenoul alone attaining this elevation. Four other *Calami* range between 1000 and 6000 feet on the outer hills, some of which are found 40 miles distant from the plains of India. The other palms of Sikkim are, "Simong,"—*Caryota urens:* it is rare, and ascends to nearly 6000 feet. *Phœnix*,‡ a small stemless species, probably *P. acaulis*, Buch. (*P. humilis*, Royle?), which grows on the driest soil in the deep valleys ("Schaap" of the Lepchas). *Wallichia*§ *oblongifolia*, Gr. (*densiflora*, Mart.), a plant having a very wide range (Assam and Chittagong). It is the "Ooh" of the Lepchas, who make no use of it; Dr. Campbell and myself, however, during a recent journey in Sikkim, found that it is an admirable fodder for horses, who prefer it to any other green food to be had in these mountains. *Areca gracilis*, the eighth, and *Licuala*, are the only other palms of these mountains; but *Cycas pectinata*, with the India-rubber fig, occurs in the deepest and hottest

* Of this I have seen two species in the mountains.

† The fruits of all the *Calami* are eaten by the Lepchas, and the stems of larger species applied to various economic purposes.

‡ The feathery fronds of the *Phœnix* are used as screens in hunting: no other use is made of any part of the plant, except that the young seeds are eaten.

§ Von Martius, in the last part of his superb work, retains Roxburgh's generic name of *Wallichia* for this palm.

valleys—the western limits of both these interesting plants. Of *Pandanus* there is a graceful species at elevations of 1000 to 4000 feet ("Borr," Lepcha).

4. The fourth striking feature is a wild plantain, which ascends to above 6000 feet ("Lukhlo," Lepcha). This is replaced by another and rather larger species at lower elevations; both ripen austere and small fruits, which are full of seed and quite uneatable; good specific characters may be drawn both from the male flowers, and from the size, form, and colour of the seeds. The commonly cultivated plantain of Sikkim is, I am always assured, an introduced stock (nor have the wild species ever been cultivated): it is very large, but poor in flavour, and does not bear seeds.

The zones of these conspicuous plants are very clearly defined in descending anywhere from Darjiling, and especially if the traveller, standing on one of the innumerable spurs which project from the ridge, cast his eyes up the gorges of green on either hand. Firing the forest is easy in the drier months of the year, and a good deal of cultivation is met with on the spurs, at and below 5000 feet, the level generally inhabited by the Lepchas, Limbos, and Sikkim* Bhoteas. The mountain slopes are so steep, that these spurs, or little shelves, are the only sites for habitations between the very rare flats on the river banks, and the mountain ridges, above 6000 feet, beyond which cultivation is rarely, if ever, carried by the Lepchas. The crops are the usual ones of the plains, and the agriculture similar, with one important exception, that the rice is seldom irrigated. This appears the more remarkable, as on crossing the Singalelah range into Nepal, in localities as steep as those covered with rice crops in Sikkim, irrigation is almost universally resorted to. The varieties of grain are different, but as many as eight or ten kinds are grown without irrigation by the Lepchas, and the produce is described as very good (80 fold). Much of this success is due to the great dampness of the climate; were it not for this, the culture of the grain would probably be abandoned by the Lepchas, who never remain for more than three seasons on one spot.

At the bottom of the valley is a small village of Lepchas, Limbos, and Murmis, aggregated in groups, on one spur, and surrounded with small fields of the usual summer and winter

* I apply the term Sikkim Bhoteas to the more recent emigrants from Tibet, who have settled in Sikkim, and are an industrious, well-conducted people. The Bhoteas, again, of Bhotan, to the eastward, rarely reside except at Darjiling, and deservedly bear the worst reputation of any of the numerous people who flock to this station. They should not be confounded with any other Bhotean tribes of Tibet, Sikkim, or Nepal.

crops of the plains. The Lepcha house is far more roomy and comfortable than that of the others; it is generally square, built on posts, with a stage in front of the door, and has a low-eaved thatch of bamboo stems, split and laid flat. The walls are of bamboo wattle-work. In all respects it resembles the Bhotea house, but is smaller, and the framework is slighter, it not being worth the Lepcha's while to render his habitation strong and durable. Both Limbos and Murmis build smaller houses, sometimes on the ground, but more frequently elevated; the roof is of grass-thatch, or occasionally of a piece of bamboo matting.

The soil at the bases of these hills is very fertile, owing to the accumulation of vegetable mould brought down by the rivers, the rapid decomposition of the rocks, and the ashes of the burnt forest. Beneath the mould is generally a stratum of red clay, which uniformly covers the hills at all elevations, to a greater or less depth, sometimes even 15 feet. This varies much in quality, apparently owing to the constituents of the subjacent rocks. Of the latter some gneisses decompose with the greatest rapidity, others resist the elements for ages. A clayey soil covers even the sharpest ridges, retained in its position by the arboreous vegetation; much of it makes excellent bricks, as it contains a very large per-centage of alumina.*

A large bamboo ("Pao," Lepcha) is the prevailing plant near the bottom of these valleys; it attains a height of 40—60 feet, and the culms average in thickness the human thigh; it is not spinous, its colour is deep green or purplish, and it is used for large water-vessels. Besides this there are nearly a dozen kinds of bamboo known to the Lepchas, all of which have been pointed out to me. Whether these are different species it is impossible to say, for different genera even are too similar in their foliage to be thereby distinguished. Three kinds usually flower; and of these, two bear no leaf on the flowering plant, which dies after seeding. A certain clump of plants seems to flower at the same time, but I could not detect any cause for this isolation of the flowering plants. Bamboos, in the general acceptation of the term (for remotely allied genera bear the same trivial English name), occur at all elevations below 12,000 feet, forming even in the pine-woods, and above their zone in the skirts of the *Rhododendron* scrub, a small and sometimes almost impervious jungle. In an economical point of view they may be classed into those which split readily, and those which do not. The young shoots of one or more are eaten; and the seeds of another are made into a fermented drink: but it would take many pages

* Nearly 30 per cent., according to the analysis of my friends, J. and C. Muller, Esqs.

to describe the numerous purposes to which the various species, even in Sikkim, are put.

Gordonia is here common (*G. Wallichii?*); it is an erect and handsome tree, much prized in all parts of the Himalaya, and universally adopted for ploughshares and other purposes requiring a hard wood: it is the "Sing-brang-kun" of the Lepchas, and ascends to 4000 feet. In very dry soils it is replaced by "Sal" (*Vateria robusta*), and occasionally by the *Pinus longifolia.*

"Toon" (*Cedrela toona*), "Simalkun" (Lepcha), and another species (probably *C. serrata*, Royle), accompany the *Gordonia*, as do *Engelhardtia* (which ascends to 6000 feet), and several leguminous trees, *Acaciæ*, *Dalbergia*, *Terminalia*, and a *Sonneratia.* Oaks at this elevation occur as solitary trees, of species different from those of Darjiling. There are three or four with a cup-shaped involucre, and three with spinous involucres enclosing the nut; these generally grow on a dry clayey soil.

Phyllanthus emblica, *Grislea*, *Symplocos*, and other small trees and bushes of the plains, occupy the more open spaces near the streams. *Cucurbitaceæ*, *Marlea*, and scandent *Leguminosæ* skirt the forest. *Fici* and *Chloranthus* with Ferns inhabit rocky places, and an amaranthaceous plant climbs over the loftiest trees; its abundant inflorescence, like hops, whiten the forest in some places. *Sterculiæ*, of two species, are common, as is *Pæderia fœtida*, which, as well as many *Cucurbitaceæ*, peppers, *Gnetum*, *Porana*, a few other *Convolvulaceæ*, and many *Asclepiadeæ*, *Hoÿa*, &c., climb high.

Though the temperature of the air was only 77° at noon, these valleys are close and oppressively hot: the streams small and varying in temperature, according to the exposure of their banks; that of the first we crossed was 70°.

Some low steep spurs were well cultivated, though the angle of the field was upwards of 25°: the crops, chiefly maize, now sprouting. This plant is occasionally hermaphrodite in Sikkim, the bisexual flowers forming a large drooping panicle and ripening small grains; it is, however, a rare occurrence, and the specimens are highly valued by the people.

On the ridge a "Semul" tree (*Bombax*) grows, at upwards of 3000 feet: it is rare at this elevation, or anywhere else upon the mountains. *Mussænda* is conspicuous for its white calycine leaves. A *Lysimachia*, very like the *L. nemorum* of Europe, grew beneath it.

Descending to another stream, the path led through a low dense jungle of bamboo and figs* of several species. Indeed,

* One species of this very tropical genus ascends almost to 9000 feet on the outer range of Sikkim.

the general prevalence of these and their allies, the nettles, is a remarkable feature in the botany of the Sikkim Himalaya, up to nearly 10,000 feet. Of figs there were here five species, some bearing eatable and very palatable fruit of enormous size, others with the fruit small and borne on prostrate leafless branches, which spring from the root of the tree and creep along the ground. A small wild mulberry tree is common in these situations, with three species of nettle,* several of *Bœhmeria*,† *Procris*, *Trophis*, *Celtis*, and *Conocephalus*. Of shrubs there are *Randia*, *Gardenia*, *Rondeletia*, *Citrus*; *Rotlera*, and other *Euphorbiaceæ*, some *Sapindaceæ* and *Terebinthaceæ*. *Scitamineæ* were not above ground; grasses are rare, as indeed are most monocotyledonous plants at this season. Of terrestrial *Orchideæ* there are several species: in the valleys, *Dendrobium* takes the place of *Cœlogyne*, the common epiphytical genus at Darjiling.

A troublesome dipterous insect (the "Peepsa") swarms on the banks of the streams; it is very small and black, floating like a speck before the eye—its bite leaves a small spot of extravasated blood under the cuticle, very irritating if not opened.

We crossed the Little Rungeet river at 4 P.M., and found its temperature 69°, and that of the air 75°.

Thence we ascended another steep spur from the base of Tongló, and camped. The night was calm and clear, with faint cirrus, but no dew. A thermometer sunk 2 feet in rich vegetable mould stood at 78° two hours after it was lowered, and the same on the following morning. This probably indicates the mean temperature of the month at that spot, where, however, the dark colour of the exposed loose soil must raise the temperature considerably.

May 20th.—Temperature at sunrise 67°; morning bright, clear over-head, but the mountains threatening. Darjiling, perched on a ridge 5000 feet above us, had a singular appearance. We descended from the spur to a narrow ravine, choked with *Calami*, figs, and the *Wallichia*, and crossing a stream ascended the Simonbong spur of Tongló, so called from a small village and Lama convent of that name on its summit. They cultivate here rice, murwa (*Eleusine*), millet, yam, brindjal, *Solanum melongena*, bhang, *Cannabis sativa*, buckwheat of two species, fennel and cummin, &c. A white-flowered Rue, *Ruta albiflora*, is wild at elevations of 3000 to 7000 feet, and is sometimes cultivated; it is used for all diseases of fowls, mixed with their food.

Celastrus, *Myrsine*, *Embelia*, *Ardisia*, and *Mæsa* all occur at 3000 to 6000 feet, and we passed through groves of a handsome shrubby purple *Tephrosia* in full flower. Near the top of

* Of two of these cloth is made, and of a third cordage. The tops of two are eaten, as are several species of Procris?

† Two species yield a fibre: one is the "Poa."

the spur *Osbeckia* and several species of *Rubus* appeared; and hence upwards the brambles are very frequent, twelve species occurring between this level and 10,000 feet. They flower at different seasons; one was bearing large-sized, well-flavoured yellow fruits, as big as raspberries.

At noon we arrived at the top of the spur, and passing some chaits,* gained the Lama's residence and temple. The latter is nothing more than a rather large wooden Bhotea house raised on a stone platform. As we stopped here on our way down, I shall allude to it afterwards more particularly.

Two species of bamboo, "Payong" and "Praong" of the Lepchas, here replace the "Pao" of the lower regions. The former was flowering abundantly, the culms, which were 20 feet high, being wholly a diffuse panicle of inflorescence. The "Praong" bears a round head of flowers at the apices of the leafy branches. Wild strawberry, violet, *Lysimachia* of several species, *Geranium*, *Polygonum*, *Veronica*, &c., announced our approach to the temperate zone. Around the temple were potato crops and peach trees. The potato thrives extremely well in Sikkim, though I think the root cultivated in the plains of India from the Darjiling stock is superior both in size and flavour. Peaches never ripen in this part of Sikkim, apparently from the want of sun; the tree grows well at 3000 to 7000 feet, and flowers abundantly, and its fruit makes the nearest approach to maturity (according to the elevation) from July to October. At Darjiling it follows the English season, flowers in March and fruits in September, when the scarce reddened and still hard fruit falls from the tree.

It is curious that throughout this, the temperate region, there is hardly an eatable fruit except the native walnut.† English cultivated fruits are extremely poor; the native are confined to the walnut, some poor brambles, of which the "yellow" and "ground raspberry" are the best, some insipid figs, and a very austere crab-apple. The European apple will hardly ripen, the pear not at all. Currants and gooseberries show no disposition to thrive, and strawberries, which grow well, ripen a flavourless

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* The chait of Sikkim, borrowed from Tibet, is a square pedestal surmounted with a hemisphere, the convex end downwards, and on it is placed a cone, with a crescent on the top. These are erected as tombs to Lamas, and as monuments to illustrious persons, and are venerated accordingly, the people always passing them from right to left, often repeating the invocation, "Om mani Padmi hom."

† The walnut of Sikkim has an extremely hard shell, whilst that of Bhotan has a remarkably thin one. In both the kernel is excellent, but in Sikkim not worth the trouble of freeing from the shell. Bhotan walnuts are largely exported, and are in all respects excellent.

berry. Vines, figs, pomegranates, plums, apricots, &c. will not succeed even as trees.

European vegetables again grow and thrive remarkably well throughout the summer of Darjiling, and the produce is very fair, sweet and good, but inferior in flavour to the English.

Of tropical fruits cultivated below 4000 feet the orange and banana alone are frequent, with lemons of various kinds. The season for these is however very short: that of the plantain might with care be prolonged, but the fruit, as I have said above, is poor; oranges abound in winter, and are excellent in flavour, but neither so large nor free of white pulp as those of South America, the West Indies, or W. coast of Africa. Mangos are brought from the plains; they do not thrive in the valleys; and though I have seen the pine-apple plant, I never met with its fruit.

A singular and almost total absence of the light and heat of the direct rays of the sun in the fruiting season, is the cause of this dearth. Both the farmer and orchard gardener know full well in England the value of a bright sky as well as of a warm autumnal atmosphere. Without this corn does not ripen, and the fruit trees are blighted. The winter of the plains of India being more analogous in its distribution of moisture and heat to a European summer, such fruits as the peach, vine, and even plum, the fig, strawberry, &c., may be brought to bear well in March to April and May, if they are only carefully tended through the previous hot and damp season, which is, in respect to the functions of flowering and fruiting, their winter.

Hence it appears that, though some English fruits will turn the winter solstice of India (November to May) into summer, and then flower and fruit, neither these nor others will thrive in the summer of 7000 feet on the outer Himalaya, though its temperature so nearly approaches that of England, by reason of the accumulated evils of its excessive rains and fogs. Further, they are often exposed to a winter's cold no less rigorous than the average of that of London, the snow lying for a week on the ground, and the thermometer descending to 25°. It is true that in no case is the extreme of cold so great here as in England, but it is sufficient to check vegetation, and to prevent fruit trees flowering till they are fruiting in the plains. There is in this a great difference between the climate of the central and eastern and western Himalaya, at equal elevations. In the eastern (Kumaon, &c.) the winters are colder and more comfortless than in Sikkim—the summers warmer and less humid. The rainy season is shorter, and the sun shines so much more frequently through the heavy showers that the apple and other fruits are brought to a much better state. It is true that the rain gauge may show a greater fall there, but this is no measure

of the humidity of the atmosphere, and still less so of the amount of the sun's direct light and heat intercepted by aqueous vapour. It takes no account of the quantity of moisture suspended in the air, nor of the depositions from fogs, which are far more fatal to the perfecting of fruits than the heaviest brief showers.

In the valley of Nepal, Mr. Hodgson informs me that at 4000 feet the apple, though flavourless, ripens well and is a good fruit, as are two varieties of the European fig; but these ripen at the same seasons as they do in the plains, the winters being so mild that snow is rare, and never lies. There, however, the plantain and mango do not ripen, nor the orange always. It is too warm for gooseberries, currants, and raspberries, and too rainy for the vine. Apricots may be produced with care, but seldom peaches.

The Indian solstices, which are marked by one season of excessive drought, and the other of excessive humidity, can never be favourable to a copious fruit market. The obstacles to the production of good European fruits, either in the plains or hills, are manifest, nor do the tropical kinds flourish as in other quarters of the globe, where the seasons are not so contrasted. Hence there is not one good fruit peculiar to the country, and perhaps but one which arrives at full perfection; namely, the mango. The plantains are good, so are the oranges and pine-apples, but are less abundant, and of inferior kinds, and remain a shorter season in perfection than they do in most other equally warm climates. Who that has walked the fruit-markets of South America, the West Indies, or Western Africa, has not been struck with the profusion of all the above fruits throughout the year, and of many more besides, which are unknown to India?

On ascending Tongló we left cultivation and the poor groves of peaches at 4000 to 5000 feet (and this on the E. exposure, which is by far the sunniest), the average level to which agriculture reaches in Sikkim; though both in Bhotan and in E. Nepal cultivation is carried much higher, the more flourishing salt trade, and probably the easier nature of the passes, favouring the formation of fixed habitations much nearer to the perpetual snow than in Sikkim, where the enormous mass of Kunchin-jinga intrudes its snows considerably south of the main range, and forbids cultivation within upwards of fifteen miles from its summit: its uniform clothing of forest too allows of no pasturage.

Above Simonbong the path up Tongló is little frequented; it is one of the many routes between Nepal and Sikkim which cross the Singalelah spur of Kunchin-jinga, at various elevations, generally lower as they approach the plains of India, and varying from 6000 to 7000 feet. As usual, the track runs along ridges wherever these are to be found, very steep, and narrow to the

top; through deep humid forests of oak and *Magnoliaceæ*, many *Lauri*, both *Tetranthera* and *Cinnamomum*, one species of the latter ascending to 8500 feet, and one of *Tetranthera* to 9000. Chesnut and walnut here appeared, with *Elæocarpus*, and some leguminous trees, which however did not ascend to 6000 feet. Scarlet flowers of *Vaccinium serpens*, an epiphytical species, were strewed about, and above these the great blossoms of a *Rhododendron* and *Manglietia ?* lay together on the ground. The *Rhododendron Dalhousiæ* is a beautiful epiphytical species, growing on the larger oak limbs, and bearing clusters of 6 to 8 flowers of great size; they are pure white, and deliciously scented of lemon. The *Manglietia* forms a large tree, of which the foliage is very dense, and of a deep shining green. Most of the flowers drop unexpanded from the tree, and have a very sweet aromatic smell; they are as large as the fist, the outer sepals purple, the inner pure white. It may be the *Liriodendron liliifera*, Willd. (Rox. ii. p. 654). The fruit differs from both *Magnolia* and *Michelia*, and I need not say equally so from *Liriodendron*. In every flower I picked up, there was a grub of a lamellicorn beetle in the centre of the receptacle.

Heavy rain came on at 3 P.M., obliging us to take insufficient shelter under the trees, and finally to seek the nearest camping ground. For this purpose we ascended to a spring, called Simsibong, at an elevation of 6000 feet. The narrowness of the ridge prevented our pitching the tent, small as it was; but the Lepchas rapidly constructed a house, and thatched it with bamboo and the broad leaves of the wild plantain. A table was then raised in the middle, of 4 posts and as many cross pieces of wood, lashed with strips of bamboo. Across this, pieces of bamboo were laid, ingeniously flattened, by taking cylinders, crimping them all round, and then cutting each down one side, so that it opens into a flat slab, several inches across. Similar but longer and lower erections, one on each side the table, formed bed or chair; and in one short hour, half a dozen men, with only long knives and active hands, had fitted us with a tolerably water-tight furnished house. A thick flooring of bamboo leaves kept the feet dry, and a screen of these and other foliage all round rendered the habitation tolerably warm.

It is a little below this elevation, 3000 to 5000 feet, that great scandent trees of the forests, either wholly enveloping trunks of others or twisting around them, strangle the greatest of these, which, decaying within their folds, leave the reticulated sheath of climbers as one of the most remarkable vegetable phenomena of these mountains. They belong to several orders, and may be roughly classified in two groups—1. those which merely twine, and by constricting certain parts of their support, produce death;

2. those which form a reticulated mass or network round the trunk, by the coalescence of their lateral branches and rootlets, &c.: these wholly envelop and often conceal the tree they enclose, whose branches appear far above those of its destroyer. To the first of these groups belong many natural orders, of which the most prominent are *Leguminosæ* (*Bauhinia*, *Cæsalpinia*, *Dalbergia*, *Milletia*, *Butea*, *Mimosa*); Vines, *Pothos*, *Combretaceæ*, *Menispermaceæ*, *Malpighiaceæ*, and a few other natural orders. The inosculating ones are almost all figs and *Wightia*.

At night the Lepchas sit late chatting round the fire, wretchedly housed, miserably clad, and very insufficiently fed. A more thoroughly happy people it would be difficult to find any where; they very rarely quarrel among themselves, and their disposition is singularly cheerful and lively. The flute is their favourite and only musical instrument: it is of bamboo; has only 4 equi-distant holes, situated far below the mouth-hole, which again is remote from the butt end of the instrument; and it is very difficult to sound. I have often listened with real pleasure to the simple music of this rude wind instrument; its low and sweet tones are singularly Æolian, as are the airs usually played, which fall by octaves: it seems to harmonize with the solitude of their primæval forests.

A thermometer sunk 2 feet 4 inches in the deep vegetable mould and clay fell to 62°, and stood at 61·7 on the following morning.

Except for the occasional hooting of an owl, the night was profoundly still for several hours after dark, it being too early in the season for the cicadas. A dense mist shrouded every thing, and the rain pattered on the leaves of our hut. At midnight a tree frog broke the stillness with his curious metallic clack, and others quickly joining in the chorus, they kept up their strange music till morning. This is called the "Simook" (Lepcha), and like many Batrachians, has a voice less like that of an animal than any organized creature I know. The cries of beasts, birds, and insects are all explicable to our senses, and we can recognize most of them as belonging to such or such an order of animal; but the voices of many frogs are like nothing else, and allied species utter totally dissimilar noises. In some, as this, it is like the sound of the concussion of metals, in others of the ringing of steel or brass—any thing but the natural effects of lungs, larynx, and muscles.*

May 21st.—Early this morning we proceeded upwards, our

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* A very common Tasmanian species utters a sound that appears to ring in an underground vaulted chamber beneath the feet.

prospect more gloomy than ever. The road, still carried up steep ridges, was very slippery, owing to the rain upon the clayey soil, and was only passable from the hold afforded by interlacing roots of trees. At 8000 feet some enormous detached masses of micaceous gneiss rise abruptly from the ridge ; these are covered with mosses, ferns, *Cyrtandreæ* and *Begoniæ*, and creeping *Urticeæ*. Such masses occur on all the sharp ridges, and at all elevations; they project awkwardly through the soil, and are strangely confused and distorted in their stratification, down even to the ultimate lamination of the mica, felspar, and quartz. They are never *in situ*, and are generally strangely shattered, and evidently not the mere exposed top of any continuous rock forming the nucleus of the mountain. A uniformly dipping stratified rock of any extent would, if raised at the angle of the slopes of these hills, present a precipitous face somewhere; but the ranges of 4000 to 8000 feet ramify and inosculate in all imaginable directions, without presenting a bold face any where near Darjiling. The road cuttings from the plains to the Sanatarium, as well as the landslips, reveal highly inclined continuous strata, all variously distorted and much dislocated, but these are only at the foot of the hills. Above 4000 feet all appears a strangely piled mass of gneiss rocks, with no uniformity of dip. Amongst these the red clay lies deeper or shallower as the hollows retain it or otherwise.

These rocks are scaled by means of the roots of trees, and from their summit (7000 feet) a good view of the surrounding vegetation is obtained. The mass of the forest is formed of (1) three species of oak, of which *Q. annulata?* with immense lamellated acorns, and leaves sometimes 16 inches long, is the tallest and the most abundant. (2) Chesnut. (3) *Laurineæ*, of several species, beautiful forest trees, straight-boled and umbrageous above, chiefly *Tetranthera* and *Cinnamomum*. (4) *Magnoliaceæ;* three species of *Michelia*. Other trees are *Pyrus*, *Saurauja* (both an erect and climbing species), *Olea*, cherry, birch, alder, maple (*Acer*), *Hydrangea*, and one species of fig; holly; several *Araliaceous* trees. Arborescent *Rhododendrons* commence here with the *R. arboreum*, which only occurs at one spot near Darjiling (Mr. Hodgson's grounds on Jillapahar, 7500 feet). *Helwingia* * and brambles are the prevalent shrubs. Ferns were not yet fully expanded, and the upper limit of the tree ferns was passed. This is the region of pendulous mosses, lichens, and

* A new species of this most remarkable genus, which I propose naming after M. Decaisne, the able describer of the natural order, which hitherto included but one species, a native of Japan. The place of this genus in the vegetable kingdom has been considered doubtful: I regard it as a reduced form of *Araliaceæ*.

many herbaceous plants; of which latter, except *Arums*, few had yet appeared above ground. The pendulous mosses are chiefly species of *Hypnum*, *Neckera*, &c.: the lichens, *Borrera* and *Usnea*. Of *Arums*, *Arisæma speciosum* particularly affects this level, with some green spotted compound-leaved kinds, and the small *Remusatia* (*vivipara?*) on the rocks and trunks of trees. Neither *Pothos* (*Scindapsus*) *officinalis*, *decursiva*,* nor *scandens* are found higher up the mountain; *Arum curvatum*, Roxb., and other species of *Arisæma*, are very frequent. *Calla*, *Colocasia*, and *Lasia* are confined to lower levels. Peppers reach this elevation, but no higher; whilst very prevalent shrubs are *Adamia cyanea*, *Pittosporum*; *Eurya* and *Camellia* in drier places: *Hypericum*; some species of *Vitis*; and several *Cucurbitaceæ*, *Zanthoxylon* and *Sapindaceæ*.

Still ascending along very slippery paths, a considerable change is found in the vegetation of the following thousand feet, from 8000 to 9000. In the forest two gigantic species of *Magnolia* replace the *Michelias*, and were just past flowering. The *Quercus annulata* is less abundant. Chesnut disappears, with several *Lauri*; other kinds of maple are seen, and the *Rhododendron arboreum* is replaced by a much handsomer species, with capitula of very large white flowers and magnificent foliage, 16 inches long (*R. argenteum*). *Corneæ*, *Viburnum*, *Lonicera*, and *Aucuba* are frequent, with two or three *Hydrangeas*, many *Laurinæ*, and some new oaks. *Helwingia* is still more abundant as a bush, with climbing and shrubby *Smilacineæ*, epiphytical and other *Vaccinia*, and *Gualtheriæ*. *Stauntonia* forms a handsome climber, with beautiful pendent clusters of lilac blossoms. The *Araliaceæ* are chiefly scandent species, and herbaceous, as *pseudo-ginseng*. *Symplocos*, *Limonia*, and *Celastrus* are common shrubs, and small trees. *Cissus capreolata* clothes the trees up to this height.

At 9000 feet we arrived on a long flat spur or shelf of the mountain, covered with lofty trees, and a dense jungle of small bamboo. *Magnolias* here formed the majority of the trees, with a few oaks (*annulata* very rare). Great *Pyri* and two other species of *Rhododendron*, both attaining the height of 30 to 40 feet, *R. barbatum*, Wall., and *R. arboreum*, Wall., var. *roseum*, De C.; *Sphærostemma*, a scandent *Araliacea*, and a *Saurauja* climb the loftiest trees: *Stauntonia* crawls round their base, or over lower bushes. *Limonia* and *Symplocos* are the common shrubs. A beautiful orchideous plant, with pale purple

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* The juice of this or a nearly allied species is used by Lepchas and Bhoteas for fixing the poison of *Aconitum* and other plants on their arrow-heads. It is said to increase the effect of the poison.

flowers (*Cœlogyne Wallichii*), grows on the trunks of all the great trees, and attains a higher elevation than most other epiphytical species, for I have seen it at 10,000 feet. A very large, broadly cucullate spathed *Arisæma* first appears at 8000 feet, and is abundant thence to the top of the mountain, where smaller kinds are found at 10,000 feet.

It is to be remarked that *Leguminosæ* are all but unknown in this part of Sikkim above 6000 feet, except the *Parochetus communis*, which however I did not see on this ascent. This total absence of one of the largest and most ubiquitous natural orders through 4000 feet of elevation is most remarkable, and characterizes much of the Himalayan range of Sikkim. I know of no parallel case anywhere on the globe. In the equally humid forests of South Chili and Fuegia the order is extremely rare, but species do exist, and the whole flora of those countries is much poorer in numbers than this. Grasses are also extremely scarce above 4000 feet and below 10,000 feet, always excepting the bamboos, which by their giant dimensions may be fancifully supposed to compensate for the want of many herbaceous species: or it may perhaps be stated better thus:—where the proportion of trees is very great, both in number of species and of individuals, arboreous grasses replace the herbaceous species of less jungly regions.

A loathsome tick infests the small bamboo, and a more hateful insect I never encountered. The traveller cannot avoid these coming on his person (sometimes in great numbers) as he brushes through the forest. They are often as large as the little finger nail, get inside one's dress, and insert the proboscis deeply without pain. Buried head and shoulders, and retained by a barbed lancet, it is only to be extracted by main force, which is very painful. I have devised many tortures, mechanical and chemical, to induce these disgusting intruders to withdraw the proboscis, but in vain.

Leeches* swarm at below 7000 feet; a small black species above 3000, a large yellow-brown solitary one below that. They are troublesome, but cause no irritation. In August and Sep-

* I cannot but think that the extraordinary abundance of these *Annelides* in all the grazing-grounds of Sikkim may cause the death of many animals. Some marked murrains have followed very wet seasons, when the leeches swarm more than ever; and the disease in the cattle, described to me by the Lepchas as in the stomach, in no way differs from what leeches would produce. It is a well known fact that these creatures have lived for days in the fauces, nares, and stomachs of the human subject, causing dreadful sufferings, and death in the latter case. I have seen the cattle feeding in places where the leeches so abounded that fifty or sixty were frequently together on my ankles.

tember these absolutely swarm, and are no less troublesome to man than to the feet of the ponies.

The rain continuing heavily, we rested the men by some large pools on the flat. A small *Lobelia*, *Chrysosplenium*, *Procris*, and *Callitriche* formed a sward on the banks, amongst which some *Ranunculi* grew (*diffusus*, Wall., and a similar species). A large and handsome *Carex* flourished in the water.

Ranunculus, though so common a genus literally almost everywhere else, is extremely scarce in the temperate and tropical zones of the Sikkim Himalaya: *R. sceleratus* abounds in the plains close to the foot of the hills, but between that elevation and 10,000 feet I have nowhere seen this or any other species. Here, and probably elsewhere in the Himalaya, the genus is very rare in these zones, though more abundant in the arctic zone above.

Cruciferæ is another natural order very frequent in the temperate and mountainous regions of all the world, except the Sikkim Himalaya. A variety of *Cardamine hirsuta?* is absolutely the only plant of this order occurring wild between the plains of India and the summit of Tongló.

Compositæ again are far from represented on the scale they are everywhere else. Though about Darjiling, where clearances have been effected, the amazing prevalence of *Gnaphalium* and *Anaphalis*, &c., gives an appearance of usual abundance of *Compositæ*, these very species will be found elsewhere scarce in the temperate zone of southern Sikkim.

Labiatæ are also poorly represented, except in clearances.

As far as I can guess, this paucity of representatives of orders for which the temperature of the Sikkim Himalaya is admirably adapted, can best be attributed—(1.) to the uniform luxuriance of the arboreous vegetation, and the absence of either precipices or naked spots of any kind. (2.) to the humid atmosphere; for some of these groups, as *Leguminosæ*, are very rare in equally temperate climates which, in respect of humidity and equability of temperature, can be compared with Sikkim, namely, New Zealand and Fuegia. There, as here, *Cruciferæ*, *Compositæ*, *Ranunculi*, *Labiatæ*, and above all, *Leguminosæ* and grasses, are very rare in the forest region.

Our ascent to the summit was by the bed of a watercourse, now a roaring torrent, from the heavy and incessant rain. A small *Anagallis* (like *tenella*) and a scapeless *Primula* grew by its bank, also some small *Carices*, and *Hemiphragma*. The top of the mountain is another flat ridge, with depressions and broad pools or small lakes, in which grew an *Iris*. A square platform, raised by the Surveyor General (whose party were the only Europeans who had previously to ourselves visited this

mountain), which had been cleared from jungle only eight months before, was already fast getting choked with bamboo and various trees.

Upon the very top, though only about 500 feet above the flat, the number of additional species was great, and all betokened a rapid approach to the alpine region of the Himalaya, though large forest trees still abounded. In order of prevalence the trees are,—*Rhododendrons* of three species. (1.) *R. arboreum*, var. *roseum*, in large bushy trees, 40 feet high. These ramify from the ground, the lower branches being long and spreading, and the apices of all loaded with a superb scarlet inflorescence. (2.) *R. barbatum*, a tree of nearly the same height, but not so spreading; flowers as copious and beautiful, but foliage brighter, more luxuriant and handsomer. (3.) *R. Falconeri*, in point of foliage the most superb of all the Himalayan species; trunks inclined, 30 feet high, branching but little, bark very smooth and papery. Branches naked, except at the apices, where clusters of white flowers are borne; the corollas are 10 cleft, and the stamens numerous. Leaves 18 inches long, very thick, above deep green, underneath wrinkled and covered with a rich, deep chesnut-brown tomentum. Next in abundance to *Rhododendrons* are shrubs of *Limonia*, *Symplocos*, and *Hydrangea*, forming small trees; there are still a few *Magnolias*, very large *Pyri*, of three species, and yew,* the latter 18 feet in circumference; besides these, *Buddleia*, not in flower, *Pieris*, *Andromeda*, *Olea*, *Celastrus*, *Cerasus*, and *Daphne cannabina*. A white flowered rose, *R. sericea*,† was very abundant, growing erect, its numerous inodorous flowers pendent, apparently as a protection from the dashing rain. *Sphærostemma*, *Sabia*, *Stauntonia*, and *Clematis montana?* were the prevailing climbers. I met with a cucurbitaceous plant at this great elevation, a *Smilax* and *Asclepiadeous* genus. A currant was common, always growing epiphytically on the trunks of large trees. Two or three species of *Berberis* and maple, I think, nearly complete the list of woody plants. Amongst the herbaceous and smaller shrubby plants were many of great interest, as a rhubarb, and *Aconitum palmatum*,‡ a very pretty species, which, as well

* The red bark of the yew is used as a dye, and for staining the foreheads of the Brahman Ghorkhas in Nepal.

† This is the only species of rose occurring in Southern Sikkim.

‡ Probably Bikh is yielded by various *Aconita*. The name of both the Sikkim Aconites is Bikh-gniong, by Lepchas and Bhoteas, who do not distinguish the two species by the roots. Another far more powerful Bikh is yielded by a plant of the order *Compositæ*, which I have gathered abundantly at 10,000 and 9000 feet; and it requires care to distinguish its root from that of the Aconites. When mixed, the Bhoteas could not separate them.

as various congeners, yields the "Bikh" poison of E. Nepal, Sikkim, and Bhotan. *Thalietrum*, one species. *Anemone vitifolia*, *Fumaria*, two *Violæ*, *Stellaria*, *Hypericum*, *Geranium* two species, two Balsams, *Epilobium*, *Potentilla*, *Paris* (7000 to 10,000 feet), *Panax pseudo-ginseng*, and another species, *Meconopsis Nepalensis*, two species of *Gentiana*, *Ligularia*, and two *Crawfurdiæ*, two species of *Arisæma*, *Anagallis*, *Hemiphragma*, and *Ajuga*, *Disporum*, and three *Convallariæ*, one with verticillate leaves, whose root is called another "Bikh," and considered very virulent. *Gramineæ* were very few in number, but a large *Carex* covered the ground, amongst the bamboo.

Still the absence or rarity of several very large natural families at this elevation, which have numerous representatives at and much below the same level in the Western Himalaya, indicates a certain peculiarity in Sikkim. These are the following:—*Ranunculaceæ*, *Fumariæ*, *Cruciferæ*, *Alsineæ*, *Geraniæ*, *Leguminosæ*, *Potentilla*, *Epilobium*, *Crassulaceæ*, *Saxifrageæ*, *Umbelliferæ*, *Lonicera*, *Valerianeæ*, *Dipsaceæ*, various genera of *Compositæ*, *Campanulaceæ*, *Lobeliaceæ*, *Gentianæ*, *Boragineæ*, *Scrophularineæ*, *Primulaceæ*, *Gramineæ*.

All the above are genera of the north temperate and subarctic zones, which affect a much higher level in this part of Sikkim than in the Western Himalaya or Bhotan—the difference in this respect being very much greater than the small disparity of latitude will account for, or than the (if there be any) difference of mean temperature, for the snow-line is certainly very little different here from that of the N.W. Himalaya. On the other hand, certain tropical genera are more abundant in the temperate zone of the Sikkim mountains, and ascend much higher there than in the Western Himalaya. Of this fact I have cited conspicuous examples in the palms, plantains, and tree-fern ascending to nearly 7000 feet, and in the presence of many other orders at great elevations, as figs, peppers, *Lauri*, &c.; and to these could be added many others, none more remarkable than *Balanophora*, of which there are several species above 4000 and even 6000 feet, one ascending to 11,000 feet.

This ascent and prevalence of tropical species is due to the humidity and the equability of the climate in this temperate zone, and is perhaps the direct consequence of these conditions. An application of the same laws accounts for the extension of similar features so far beyond the tropical limit in the Southern Ocean, where various natural orders which do not cross the 30th and 40th parallels of N. latitude, are extended to the 55th in Tasmania, New Zealand, the so-called Antarctic Islands south of that group, and to Cape Horn itself in Fuegia.

The forest region, encroaching so far upon, and in fact cover-

ing the temperate zone of the Sikkim Himalaya, and the snow-level not being proportionally higher, it follows that, *cæteris paribus*, the belt occupied by upland alpine and Arctic species is more confined, and in all probability less prolific in species, than it is in the N.W. Himalaya. Of this the rarity of Pines (themselves indices of a severe drought in the air or soil) would appear to afford a proof; for between the level 2500, the upper limit of the *P. longifolia*, and the *Taxus*, 10,000, which also coincides with the lower limit of *Abies*, there is no coniferous tree whatever in Southern Sikkim, except on the mountain faces immediately subtending the perpetual snow; and there they descend 1000 feet lower. There are only six species of *Coniferæ*, including *Taxus* and *Juniperus*, in this part of Sikkim, of which two are not common to the N.W. mountains, and none are by any means abundant.

We encamped amongst the *Rhododendron* trees, on a spongy soil, of black vegetable matter, so oozy that it was difficult to keep the feet dry. The rain poured in torrents all the evening, and this, the calm, and wetness of the wood prevented our enjoying a fire. Except a transient view into Nepal, a few miles west of us, nothing was to be seen, the whole mountain being wrapped in dense masses of vapour. Gusts of wind, not felt in the forest, swept over the gnarled and naked tree tops; and though the temperature was 50°, this produced cold to the feelings on walking about, and being exposed to it.

Our poor Lepchas were miserably off, but always happy under four posts and a bamboo-leaf thatch, and with no covering but a single thin cotton garment. They crouched on the sodden turf, joking with the Hindus of our party, who, though supplied with good clothing and shelter, were doleful companions.

I made a shed for my instruments under a tree; Barnes, ever active and ready, floored the tent with logs of wood, and I laid a "corduroy road" of the same to my little observatory.

During the night the rain did not abate; the tent-roof bagged and leaked in torrents, so that we had to throw pieces of wax-cloth over our shoulders as we lay in bed.

May 22nd.—There is no improvement whatever in the weather. Two of the Hindus crawled into the tent during the night, with fever and ague.* The tent being too sodden to carry, we had no choice but to remain where we were, and there being

* It is a remarkable fact that both the natives of the plains under many circumstances, and the Lepchas when suffering from protracted cold and wet, take fever and ague in sharp attacks. The disease is wholly unknown amongst Europeans residing above 4000 feet, similar exposure in whom brings on rheumatism and cold, even in constitutions predisposed to the former by repeated attacks of fevers in other climates.

abundance of novelty within 20 yards, there was no difficulty, with such a pursuit as botany, in getting through the day. Observing the track of sheep, we sent two Lepchas on the scent, who, after being absent the whole day, returned from some miles west in Nepal, with two sheep and as many lambs. The shepherds were Goorongs of Nepal, who were grazing their flocks on a grassy mountain top, from which the woods had been cleared; probably by fire. These to the Lepchas were a great boon, but the Hindus would not touch the flesh, and several more sickening during the day, we had the tent most uncomfortably full.*

Our inability to obtain a view was extremely disappointing, the mountain commanding a superb prospect. It embraces nearly 100 miles of the snowy range, from the far west in Nepal to Kunchin-jinga due north and its five sister-peaks, varying from 20,000 to 28,000 feet, and from which an uninterrupted succession of snowy ridges sweeps round to the east. The culminant points rise, several to 22,000, and many to upwards of 19,000 feet. Chamalari, in Tibet, rears its head above the eastern amphitheatre of snows at a distance of 80 miles. S. E. are the sub-Himalayas of Bhotan, and all between are the billowy mountain masses of Sikkim. South, the eye should have ranged over the plains of India, the courses of the Teesta, the Konki, the Cosi, and the innumerable smaller streams which debouche on the plain.

During the whole of the 22nd, from 7 A.M. to 11 P.M., the thermometer never varied 6·5 degrees, ranging from 47·5 in the morning to 54°, its maximum, at 1 P.M., and 50·7 at night. At 7 the following morning it was the same. A thermometer sunk 2 feet 6 inches in deep vegetable mould and clay, maintained for two days the constant temperature of 50·7 (alt. 10,000 feet—May). In spite of the heavy rain and fog, the dew point was always below the temperature, at which I was surprised, for more drenching weather could not well be. The mean dew point was 50·3, and consequent humidity 0·973.†

These observations, and those of the barometer, were taken some 60 feet below the summit, to which I moved the instruments on the morning of the 28th. At a much more exposed spot the results would no doubt have been different. A thermometer there sunk to the same depth as that below stood at 49·7; or one degree colder than 60 feet lower down.

The summit of Tongló, by my barometrical observations

* This was a most convenient hill tent kindly lent us by Major Crommelin of Darjiling. It can be carried on one man's shoulders, and accommodated two persons with a little management.

† As expressed by the quotient of the tension at the temperature of the dew point divided by that of the air.

taken simultaneously with those of Calcutta, gives the height 10,078·3 feet; Col. Waugh's, by trigonometry, 10,079·4 feet.

May 23*rd*.—We spent a few hours of alternate fog and sunshine on the top of the mountain, vainly hoping for the most modest view. The air, which was always foggy, was alternately cooled and heated, as it blew over the trees, or the open space we occupied, sometimes varying 5° and 6° in $\frac{1}{4}$ hour. Whenever a lull occurred the fog was sensibly heated by the sun's rays.

The number of mosses, *Hepaticæ* and *Lichens*, growing near and on the summit, is very remarkable. There were various species of ferns, and a small *Agaricus* grew on decayed twigs; lichens infested the naked branches of the rose, berberry, and cherry. The trunks of both the *Rhododendrons*, owing to their smooth papery bark, and the bamboo, are remarkably free from cryptogamic vegetation.

Having partially dried the tent in the wind, we commenced the descent, which, owing to the late torrents of rain, was most fatiguing and slippery; it again commenced to drizzle at noon, nor was it till we had descended to 6000 feet that we emerged from the region of clouds. There I met with a species of *Balanophora* * pushing through the soil; it is a new species, monoicous, the earliest flowering of any in Sikkim, and may be distinguished from its congeners by its cyathiform involucre round the middle of the pedicle.

By dark we arrived at Simonbong, having descended 5000 feet at the rate of 1000 feet an hour, and here we were kindly received by the Lama, who gave us his temple for the accommodation of the whole party. We were surprised at this, both because the Sikkim authorities had falsely represented the Lamas as very averse to Europeans, and because he might well have hesitated before giving ingress to a promiscuous horde of some thirty people into a sacred building, where the little valuables on the altar, &c. were quite at our disposal. He made but one request, that the Hindus should not smoke their hookahs inside.

Simonbong is one of the smallest and poorest Gumpas (or monasteries) in Sikkim;† unlike the better class, it is built of

* The pretty wooden cups, in universal use throughout Sikkim and Tibet, are made of knots produced by *Balanophoræ*, generally on the roots of maples.

† There are upwards of twenty Lama establishments in Sikkim, numbering eight hundred monks. Many of these are of excellent masonry, Chinese in architecture, gorgeously decorated, and, for so poor a country, richly endowed. During my more recent travels in Sikkim I have visited many, been an inmate in the monasteries, and met with the greatest kindness and hospitality from the good fathers. As the first European who had ever lived with the monks, this was the less to be expected. Dr. Campbell, who afterwards joined me, and in whose delightful society I visited others, records the same opinion of these good-natured people.

wooden beams only, and has no monuments, except the chaits mentioned on our way up the mountain. It consists of one large room, with small sliding shutter windows, raised on a stone foundation, and roofed with shingles of wood; opposite the door, which is at one end (the east), the altar is placed, of wood, chequered with black, white, and red diagonally; to the right and left are shelves with a few MS. books, wrapped in silk; a model of Symbonath temple at Nepal, in wood; a praying cylinder, and some implements for common purposes, bags of juniper, &c. On the shelves are English wine-bottles and glasses, with tufts of *Abies Webbiana*, Rhododendrons, and peacocks' feathers. On the altar seven little brass cups are ranged, full of water; a large shell carved with the sacred lotus; a brass jug from Lhassa, of beautiful design, and a human thigh-bone, hollow and perforated through both condyles. The shelves above contained various trifles, clay ornaments and offerings, and little Hindu idols brought from the Hurdwar fair.

Facing the altar is a bench and a chair, and on one side a huge tambourine, with two curved iron drum-sticks. The bench was covered with mysterious implements, bells handsomely carved with idols, censers with juniper-ashes, the *dorge* which the priest holds in his hand during service, and various water-vessels; on the stool or chair was a large platter, with a brass egg-cup inserted in it. Of these articles, the human thigh-bone is by much the most curious; it is very often that of a Lama, and the longer they are the more value is put upon them. As, however, the Sikkim Lamas are burned, these relics are generally procured from Tibet, where the corpses are said to be cut in pieces and thrown to the kites, or into the water.

The Lama was consecrated at Chungachelling, one of the oldest Sikkim convents (it has existed for three centuries), and unfortunately was not an educated or intelligent fellow.

Two boys usually reside in the temple, and their beds were given up to us, which being only rough planks laid on the floor, proved clean in one sense, but contrasted badly with the springy couch of bamboo the Lepcha makes, which renders carrying a mattress or aught but blankets superfluous.

May 24th.—We were awakened this morning by the discordant orisons of the Lama; these commenced at sunrise, by the boys coming in and beating the great tambourine close to our ears for several minutes, then blowing the conch-shells, and finally the thigh-bone, each for as long a time. Shortly the Lama entered, clad in scarlet, shorn and barefooted, wearing a small red silk cap. He walked along, slowly muttering and groaning his prayer, to the end of the apartment, whence he took a small red bag in which were a brass bell and dorge. Sitting down he

commenced matins before the chair with the brass cup, which he filled with water and placed again in the platter—took off his beads and continued counting them or beating the bell, uttering most dismal prayers in a very deprecatory tone, of which "Maliva, oh Maliva," was the burden. After various disposals of the water-jugs, cups, and platter, which were filled and refilled, rice added and sprinkled about, a large bell was violently rung for some minutes, himself snapping his fingers and uttering most unearthly sounds. Having put away those instruments, incense was brought, of charcoal with juniper-sprigs. This was swung about, and put through many evolutions, and finally, with the water, thrown out of the window, when the morning service was concluded, to our great relief, as the noises were quite intolerable.

After breakfast the Lama came to visit us, bringing rice, a few vegetables, and a large basket of fermented Murwa (seeds of *Eleusina coracana*): the latter is invariably given to the traveller, either in the state of the fermented grain, or more commonly in a bamboo jug filled with warm water and grain; the fluid sucked through a reed is a refreshing drink.

A species of *Pteris*, very like *aquilina* (which is common elsewhere in Sikkim), attains at Simonbong a height of 14 feet, as great as I ever remember having seen itself or its congeners in New Zealand.

Leaving Simonbong, we descended to the Little Rungeet, and crossed it lower down than before, thus avoiding some troublesome spurs; the heat of the valleys is very great, 80° at noon, and of the stream 69°; the latter an agreeable temperature for the coolies, who plunged teeming with perspiration into the water, catching fish with their hands.

We reached Darjiling late in the evening, and again drenched with rain; our people, Hindus and Lepchas, imprudently tarried for the night in the valleys below. Owing probably as much to the great exposure they had lately gone through, as to the sudden transition from a mean temperature of 50° in a bracing wind, to a hot close jungly valley at 75°, no less than seven were laid up with fever and ague.

Few excursions from Darjiling can, for their length, give a better idea of the general features and rich luxuriance of the Sikkim Himalaya than one to Tongló. I was amply rewarded, and my ever cheerful and active companion pronounced himself so too, though we both had fully expected better weather and some prospect, however transient or confined. It is always interesting to roam with an aboriginal, and especially a mountain people, through their thinly inhabited valleys, over their grand mountains, and to dwell alone with them in these forests, however gloomy and forbidding. No thinking man can do so with-

out learning much, though slender be the resources at his command for communion. A more interesting and attractive companion in this respect than the Lepcha I never lived with: cheerful, kind, and patient with a master to whom he is attached; rude but not savage, ignorant and yet intelligent; with the simple resource of a plain knife he makes his house and furnishes yours, with a speed, alacrity, and ingenuity that whiles away that well known long hour when the weary pilgrim frets for his couch. In all my dealings with them they have proved scrupulously honest. Except for drunkenness and carelessness, I never had to complain of any of the merry troop, some of whom, bare-headed and bare-legged, with *absolutely* nothing but a cotton garment and long knife, followed me for three months on a recent occasion, from the scorching plains to the everlasting snows. Ever foremost in the forest or bleak mountain, and ever ready to help, to carry, to encamp, collect, or cook, they cheer on the traveller by their unostentatious zeal in his service, and are spurs to his progress; for who would not go forwards where such followers are behind?

II.—*Mode of Heating adopted at Porthgwidden, near Truro.* By the Rev. T. Phillpotts, F.H.S.

(Communicated Sept. 29, 1851.)

The accompanying plans and sections refer to a forcing-pit, orchid-house, and cutting-frame, erected at this place, under my own direction, early last year. Their success has been so complete in all points, that I place the details at your disposal, that others may, if they think fit, profit by my experience. Real *usefulness* rather than *display* has been my object, and I lay no claim to novelty or invention beyond what a *practical* rather than a *scientific* adaptation or modification of the plans of others, avoiding as far as possible their defects, may deserve.

Without discussing other systems, their merits and demerits, I will only say, that I have for many years paid much attention to the best method of constructing and applying heat (especially bottom heat) to horticultural buildings. The Tank system and the Polmaise have both been tried by me at different times (under the personal advice of Messrs. Rendle and Meek), honestly and without any prejudice; but after the expenditure of a good deal of time, trouble, and money, I have arrived at the conclusion that an apparatus consisting of hot water in pipes, with open troughs connected with them, affords the simplest and cheapest,

because the most certain and efficient means of heating I have yet seen. The range consists of—

I. A forcing pit,* 42 feet by 8 feet, divided into three compartments A. B. C. of three lights each.

II. An orchid house of the same length, 10 feet wide, in two divisions.

III. A row of striking frames on the north side, to which heat may be given at pleasure.

The whole was put to work at Easter, 1850, when pit A. was planted with cucumbers (Cuthill's black and Snow's white spine I find the best), and since that time we have had a constant supply of the finest fruit, which has in every instance at five successive exhibitions carried off the first prize.

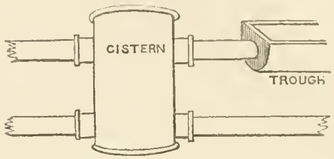
Pit B. was filled with vines in pots, which were ripened and succeeded by melons. In December a fresh lot of vines was introduced, which produced the finest crop of grapes (in pots) I ever saw. Some of the pots had as many as 14 and 15 bunches, well coloured. These were cut in May and June, from vines which were most of them *only* 15 *months old*, and on their removal melons were planted, of which there is now (Sept. 29) a good crop, nearly ripe. Pit C. has already ripened off a fine early crop of melons, one of which obtained the Bronze medal at the Botanic Society's exhibition in the Regent's Park. It is now occupied as a cool pit, with plants of various kinds.

The whole is heated by a single 24-inch ribbed boiler of Burbidge and Healey's pattern (they have in my opinion spoiled their newly *improved* (?) one by getting rid of the central tube). Perfect command of heat is given by the Sylvester fire-doors and dampers, which need no praise from me: they are admirable, and may be used with almost any boiler. The setting of the boiler, as recommended by Messrs. Burbidge and Healey, is a great advantage: the fuel does not come in contact with any of the iron work, every inch of which is, however, exposed to the action of the heat, and a system of slow combustion, regulated by dampers and by a flue, which descends a little before it goes off to the stack, economises fuel to a most surprising degree.

The pipes are 4 inches in diameter, and 1 foot from centre to centre. The open troughs are cast with a pipe at each end to fit into the sockets; they are 6 feet long and 9 inches wide at the top; depth 4 inches, with a shoulder cast in each rim to enable us to cover them with common slate, when less moisture is required; if a very dry heat is wanted, a little sand strewed

* The pits are really only 6 feet wide, but in the drawing I have made them 8 feet, as I find I have such a superabundance of heat that I now wish for the extra width. This is the only improvement I can suggest, after 18 months' trial.

over the slate keeps all tight. The heat is regulated not by expensive cocks or valves, which contract the flow, and are liable to get out of order, but by series of cast-iron cisterns



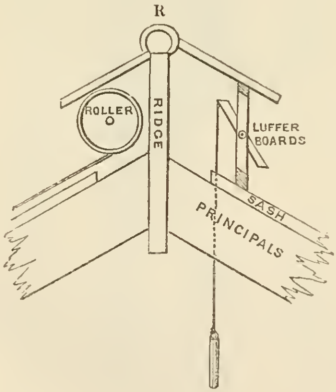
which supply the place of elbows, and being cast with one, two, or three sockets of the same bore as the pipes, may be plugged off with a common piece of wood, with a little cloth wrapped round it, so as to check or entirely cut off the supply from any part which may not need it.

But the most perfect system of heating would be vain without good ventilation night and day. If my theory is correct, the air of plant houses of this description should be in direct proportion to the light, the moisture, and to the heat. This is best attained (where the quantity is easily controlled) in a small house, for the temperature must not be lowered too much by the admission of external air, while, on the other hand, it must not be dried by artificial heat. To obviate this difficulty, you will observe an air chamber between the two buildings, which has its opening at a lower level, near the ash pit; from this chamber several small drains open into the pits, &c. 6 inches above the floor, with gratings of (about 6 inches square) perforated zinc. From these a constant supply of fresh air in small and broken quantities arises, so that no strong draught is created; and this, passing over the surface of the pipes, under which it enters, loses its chill, while the open troughs supply it with moisture; these are constantly open, but may be closed if necessary. There are also ventilators in the front and back walls, and at the top of the orchid house. It will be perceived that the ridge piece is raised above R. the roof, the south side of which carries a roller for sun-blinds, while the north side has a row of luffer boards, which are opened and shut at pleasure, by balance weights within. The front of the orchid house is fitted with Hartley's patent rough plate-glass, which answers admirably without diminishing the light; indeed, a blind is still needed for the orchids in very bright weather. One word as to drip—by adopting the pattern of sash-bar given by Mr. Lyons in his work on Orchids, this is entirely avoided, even when the house is saturated with moisture, and a cold wind blowing without.

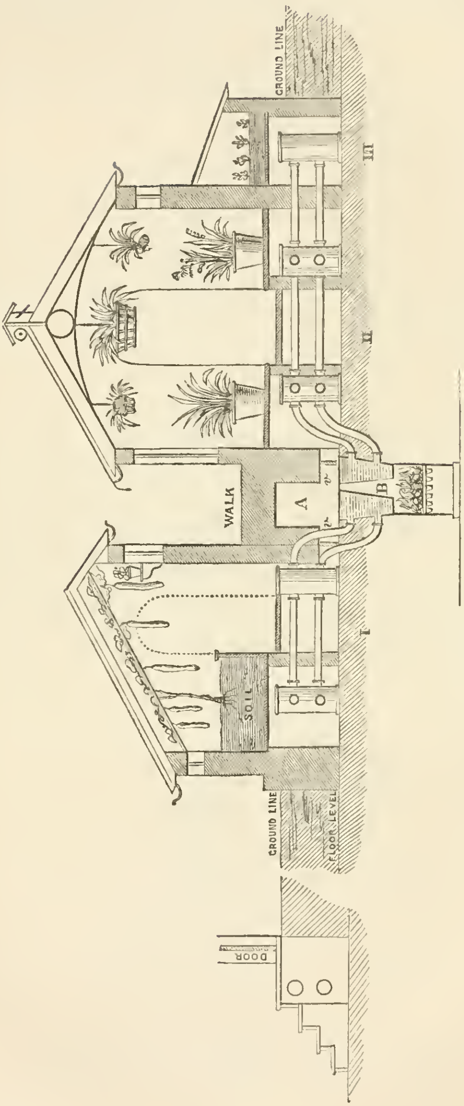
It may be objected that the cold in this neighbourhood is not excessive, the thermometer never falling below 18°, and rarely within 10° of that point. I may, however, say that we have never worked to our full power, and my gardener is so convinced of the sufficiency of the boiler, that he wishes to heat another range of store pits from the same, which he says he could easily do with little or no increase of fuel.

With these observations I leave the plans in your hands, believing that with such modifications as circumstances may require they will be found practically useful and economical, getting rid in a great measure of the nuisance and uncertainty of dung beds, and doing the real work of the forcing ground in a simple and efficient manner. Such successful results can only be expected where the gardener not merely understands but *loves* his business. It is but common justice to add, that I have the good fortune to be so assisted, and that I highly value the care, attention, and zeal with which my plans have been carried out.

Note.—I must not omit mention of the cucumber pits erected for Mr. Ludlow, at Heywood House, Wilts, from which I received much assistance, and, indeed, the first idea of my own range. They failed, however; at first from an excessive moisture, caused, as I believe, by an insufficient supply of air. I have no doubt Mr. Crane, the intelligent gardener, has long since remedied this. It may be useful to add that the entire cost of my building, including everything, was 160*l.* The consumption of fuel to keep it constantly working is about nine tons of culm (price here 14*s.* per ton) per annum.

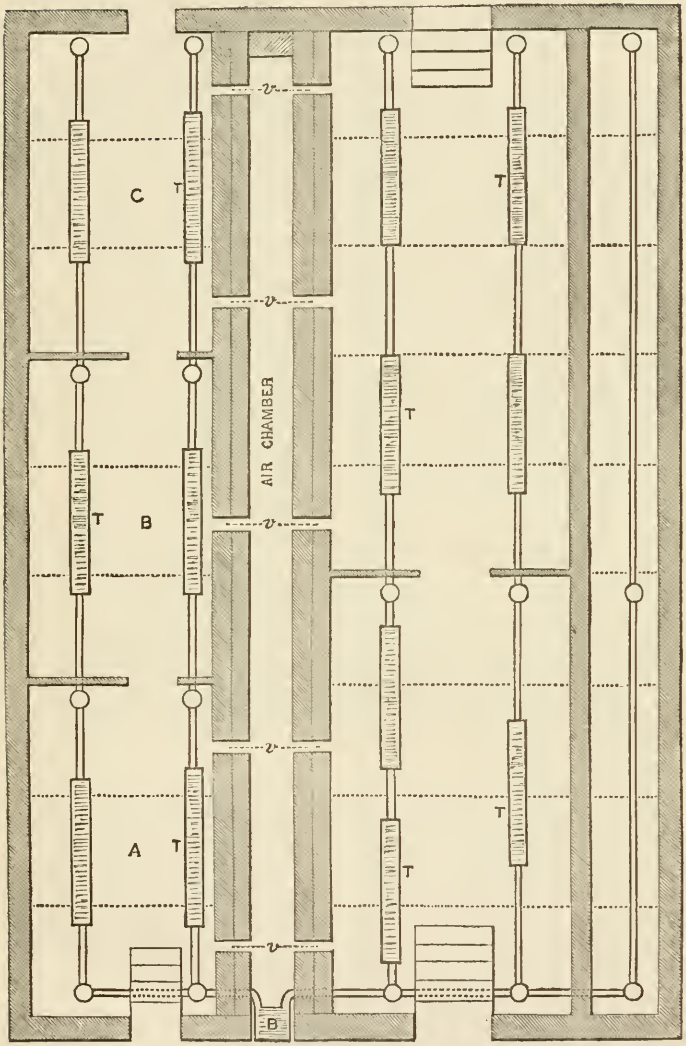


R, Roller for Blind.



I. Forcing Pit. II. Orchid House. III. Striking Pit.

[Observe that the pipes are below the external ground level; the entrance is by steps of slate, *over* the cross pipes, descending at once to the floor level. The shelves of the orchid house and the soil bed in forcing pits are formed of slate, supported by brick piers.]



Scale 1-8th. *South.*

B, Boiler. TT, Open Troughs. VV, Ventilators.

III.—*Dr. Schleiden's Theory of Agriculture.* By the Rev. M. J. Berkeley, M.A., F.L.S.*

The volume before us, whose full title we have given below, may either be considered as a distinct work in itself, or as a single volume out of three, constituting a cyclopædia of theoretic natural history for the use of agriculturists, comprising physics, inorganic and organic chemistry, meteorology, mineralogy, geology, the knowledge of soils and manures, the physiology of plants and animals, and the theory of rational husbandry. It is not our intention to advert to that part of it which relates to the physiology of plants and animals; it is to the third part only that we purpose to direct the attention of our readers, premising that in the prospectus issued by the publishers it is considered so complete as to render any more especial rules of husbandry unnecessary, inasmuch as the principles involved are so clear and certain as to enable every one who has any interest in the matter to apply them at once as any particular case may arise. While, therefore, it modestly proclaims itself merely as theory, it in point of fact professes itself as thoroughly practical.

It is in this point of view, therefore, that we think a fair abstract, conveyed as much as possible in the words of the author, may prove not uninteresting nor unsuggestive of practical good, though we are not prepared at once to adopt the views of the learned author, which are greatly at variance with many notions which are generally current amongst cultivators. Dr. Schleiden, though often paradoxical, is always an able reasoner; and whatever we may think of his new theory of the impregnation of plants, he has so many titles to merit as an excellent and acute observer, that whatever he advances is entitled at least to a candid examination.

The main position amidst others of various degrees of importance contained in the theory of the cultivation of plants is simply this, that manures do not act immediately on vegetation by means of their organic contents, but by reason of the inorganic substances which they involve. The organic portions, however, perform a part absolutely necessary to the process, as they retain the inorganic portions in their tissues, and by their power of absorption of matters contained in the surrounding atmosphere render them available for nutrition.

* Die Physiologie der Pflanzen und Thiere und Theorie der Pflanzencultur für Landwirthe bearbeitet von Dr. M. J. Schleiden, Professor an der Universität zu Jena. Braunsweig, 1850. 8vo., pp. 490 & xii. mit 154 in den Text eingedruckten Holzschnitten.

Without further preface, we proceed with our account of the argument.

There is a great difference between experience and observation; the latter merely indicates the external relation of one phenomenon with another as regards space and time; the former their intimate connection in point of cause and effect. Without experience in this true sense of the word there can be no theory. What is meant therefore in the present volume by Theory of Agriculture is only the apposition of those sciences which can alone place an intelligent cultivator in a condition to make real and useful experiments, and when a sufficient quantity of these are collected, and not till then, a theory of agriculture in the real sense of the phrase will be possible. At present we must be content by means of chemical and physical science to make agricultural experience possible.

The first question which arises is what are cultivated plants or plants of husbandry, and in what respect do they differ from wild plants. It is quite self-evident that all laws to which wild plants are subject, hold good of cultivated plants so long as their inapplicability is not proved by intrinsic difference of nature. The greater part of writers on agriculture are wholly incompetent to say whether cultivated plants are under more or less favourable circumstances than wild plants. The first thing which strikes us about those plants whose cultivation is carried on on a large scale is that they comprise a very small portion of the species which are distributed over the earth. Out of the ten thousand species of grasses scarcely twenty species are extensively cultivated; of the immense family of Papilionaceous plants, perhaps twelve; half a dozen Crucifers; scarce as many Umbellifers, Chenopods, and Solanads; besides a sprinkling of species cultivated in the tropics with which we are less familiarly acquainted.

Out of 300 families, consisting of some 200,000 species, we have mentioned nearly all that come within our present scope.

These plants may be divided into two different groups; those of which we do not know with certainty the wild state, and those whose origin is well ascertained. The most important cereals for instance, as Indian Corn, Rice, Wheat, Rye, Oats, and Barley, are never met with truly wild. All the researches of travellers in America after the wild state of the Indian Corn have been vain, and our European species which are supposed to have been derived from the East have never been found in countries except where it was more than probable that they had been introduced by the hand of man. The wild originals seem to have perished before what are called the historical ages. Nor indeed do they establish themselves in general as wild plants;

after two or three more or less abortive efforts they completely vanish.

As regards the second group, how different are the roots of our cultivated Carrots, Turnips, &c., from the dry, useless produce of the wild plant! What resemblance between our Cauliflowers, Savoys, and Cabbages, and the juiceless plants of *Brassica oleraeea* from the Dunes of the Baltic, which, nevertheless, is the origin from which they sprang? The wild Potato of Chiloë has a small, greenish, nauseously bitter root, and other instances might be alleged. The characteristic, then, of agricultural plants consists not in what distinguishes them as species, but in that which separates them as varieties from the typical form.

Moreover the natural orders to which they belong are amongst those which have an especial tendency to form varieties, in which, therefore, the distinction of species is extremely difficult, and requires great circumspection. To understand then the peculiarities of these plants we must become well acquainted with the mode of origination of varieties and subspecies. If the seeds of a double Dahlia are sown, a few only of the produce resemble the parent, the greater part differ from that and from each other; and when the same circumstances take place in the second generation the plant which exhibits them is called a *variety*. The Cauliflower, for instance, was originally a variety of the wild Cabbage. If proper attention, however, be paid to the soil, the seeds reproduce the variety with certainty, and it is then called a *subspecies*.

But few varieties arise from mere change of soil or climate: the flesh-coloured *Hydrangea* becomes blue in certain soils; some blue flowers become red when grown near anthills from the effect of the formic acid; and in a dry situation the Riband Grass of our gardens is produced from the common green form. Changes of colour and increase or decrease of vigour are effected, but new varieties in general do not arise.

Where plants are propagated by buds varieties more frequently originate. Potatoes for instance alter more or less in different soils, and Strawberries degenerate where they are allowed to spread extensively from runners.

The main source, however, of varieties and subspecies is from seed. Art indeed exercises a certain degree of power over their production, so that the expected produce is almost matter of calculation where a sufficient degree of skill is exercised. If the seeds of a variety are sown with due attention to similarity of soil and treatment, there is almost a certainty that some individual will exhibit the characters of the variety. If amongst these that one is selected which is nearest to the mother-variety, the new generation will afford a greater number of individuals true to the

desired characters, and if the experiment be continued through a series of years, the variety at last will constantly produce plants like itself, and will be then an established subspecies.

The necessary condition is, that the same circumstances of soil and cultivation should be continued through the whole process, and it is clear that by inverse treatment a plant may be made to revert to its original type.

The object then of field-culture is not plants as species, but as varieties. And as such they may be arranged in three classes. With the first of these, which regards mere general vigour of growth, as in varieties of real or artificial grasses and forest trees, we have at present little interest. Preternatural development of certain parts and modifications of chemical action are much more to our purpose. The following list comprises the most familiar instances:—

A. *Preternatural development of certain Parts.*

a. Root . . Turnips.
b. Stem . . Kohl-rabi, Cauliflower, Flax, and Hemp.
c. Leaves . Cabbages.
d. Buds, especially subterranean. Potato.
e. Fruit . . Apple, &c.
f. Seed . . Cereals, Pulse, and Oil Plants.

B. *Modifications of Chemical Action with a view to the Multiplication of peculiar Constituents.*

a. Protein . Cereals, Pulse, and Coleworts.
b. Starch . . Potato, Cereals, Pulse.
c. Sugar . . Beetroot.
d. Oil . . . Oil Plants.

The preternatural development of one part supposes peculiarities of chemical action in the whole. What then are the conditions which can induce such modifications?

To this end we must compare the circumstances attendant on natural and artificial growth, which will throw much interesting light on the nutrition of plants, and some other important points of their culture, as for instance the nature of manures.

Now there are soils extremely rich in organic substances, as peat bogs or moors. They support a very poor vegetation; poor in the number of species, their uniformity of habit, and their all but utter worthlessness. There are soils again rich in organic substances, consisting to the depth of 100 feet or more of humus, which support the most luxuriant vegetation, viz., the tropical virgin forests: their richness in species, their variety of forms, and their great utility form a striking contrast to the case just mentioned. Again, there are soils consisting of lava and volcanic ashes, with scarce a trace of humus, except such as arises from the still undecomposed remains of the plants which they have

supported, which still are remarkable for their exuberant vegetation, and which have for centuries been equally prolific without any addition of manure. The *tierra colorada* of Cuba, which is used for the cultivation of coffee and indigo, is a case in point.

Again, there are soils void of humus, which support no vegetation, or one of the very meanest character, as for instance the loose sands of the Sahara. The humus then cannot be the cause of fertility, for we find a very poor vegetation on land extremely rich in humus, and a luxuriant growth on that which is destitute of organic constituents. Nor can the presence of water be the only requisite, for if we ascribe the desolation of the desert to the absence of water, we cannot lay the blame on that in the case of peat bogs. If water be added to the loose sand, as in the forests of the German marches, we have a uniform and poor vegetation. There remains but one answer: in the soils destitute of humus it must be the mineral inorganic constituents which are the cause of luxuriance, and to the same cause must be attributed the fertility of the virgin forests of the tropics, in comparison with the barrenness of the peat bogs, though equally rich in organic matter. From the very mode of formation of peat bogs it follows that all the soluble mineral constituents are washed out and carried off, whereas in the soil of the virgin forests they are stored up, insomuch that the continued cultivation of tobacco for some centuries is required to exhaust the alkali of the North American woods.

Now if a comparison be made with our cultivated lands, it is the first superficial glance alone which recognizes any necessary proportion between the fertility of the soil and its richness in humus. Analysis shows that no such relation exists, but that the goodness of the soil depends upon its inorganic constituents, so far at least as they are soluble in water, or through continued action of carbonic acid; and the more abundant and various these solutions, the more fruitful is the ground.

But the matter may be viewed in another light. If we take the Flora of a country, as for instance that of Germany by Koch, which is perhaps the most perfect of its kind, we find plants divisible into two classes, one containing those whose forms are extremely simple and constant, and another those which are rich in remarkable and definite varieties. The latter, with few exceptions, are either Alpine plants, or such as, in our cultivated ground and its neighbourhood, are subjected to the influence of agriculture. This is the most striking when we compare the species of a particular genus with one another, and find that even nearly related species are distinguished in this respect according to their natural locality. The one is subject to produce varieties,

the other extremely constant. Now, certainly, it is not the richness in humus which induces the multiplied varieties of Alpine plants, or its comparative absence, on the other hand, which causes the poverty of forms in other species. The Alpine plants grow in a soil to which the water continually brings down the decomposed elements or the comminuted fragments of the impending rocks. The characteristic of our cultivated fields is equally the richness in soluble mineral constituents, and not the greater proportion of humus.

We may now then answer the question: What is an Agricultural plant? It is one which is distinguished from wild individuals of the same species by peculiar qualities which constitute its fitness for culture, and which depend upon a modification of chemical action.

By cultivation, in its confined sense, to the exclusion of all cases of mere promotion of luxuriant growth, is meant the production of certain definite qualities in particular individuals. There is however another end in view, namely, that of association, to the exclusion of all other plants. Even where no peculiar qualities distinguish the plant under culture from the wild state of the species, such association is necessary to save the labour of the collection of scattered individuals. Nor is this necessary association without its consequences. Most men consider plants so collected as in a far more favourable situation than they occupy by nature; but the fact is precisely contrary; for the greater part of cultivation consists in restoring the fertility which has been impaired by such association.

Although it is improbable that different natural laws prevail in the nutrition of cultivated plants from those which are wild, we must not take this for granted, but put it to a strict proof, especially since the most erroneous notions on this subject are prevalent.

The facts which follow are collected from Loudon's Encyclopædia:—

Up to the 35th degree of latitude, on either side of the equator, the farmer depends not on dung, but on irrigation; from thence to the 45th degree manure accompanies irrigation, but by no means universally; from thence to the 67th degree, which is about the limit of cultivation in Norway and Sweden, the ground is drained and manure employed. In the southern hemisphere this latter region is of little importance, while the first is of great consequence on both sides of the equator. Three-fourths then of the cultivation of the whole globe is quite independent of manure.

In the following countries organic manure is not used, and frequently impracticable from the want of beasts to yield it.

In the middle of Russia the corn which supplies the market of Odessa is produced year after year on the same ground without any manure. The straw is simply burnt. Sometimes indeed the produce is only six or seven fold, but occasionally very rich. The stems of the wheat are frequently as thick and tall as reeds, and the leaves like those of Indian corn.

In some parts of Malaga wheat and barley are grown alternately without either dung or fallow. In Arabia Felix raw manure is replaced by water or burnt camels' dung.

In Hindostan the ground yields two harvests without manure, the first principally of vetches, the latter of Indian Corn exclusively. In the rice districts, comprising a great part of Asia, organic manure is not applied. The Chinese however lay great stress on vegetable ashes, and collect the weeds for burning.

In Van Diemen's Land fifteen successive crops of wheat are taken without manure; the land is then suffered to run wild, and when covered with Acacia scrub the trees are burnt, and the soil is again fit for cultivation. The same is the case at the Cape of Good Hope, and many like instances might be produced.

As examples of plants which yield a great produce without organic manure, we may mention Indian Corn, Rice, Sugar-cane, Coffee, Cacao, Banana and Plantain, Manioc and Yam, Cotton, Indigo, and a great portion of Tobacco. In fact the 200 or 600 fold produce of Indian Corn in Mexico without any manure, puts to shame our 12 or 15 fold harvest with every effort of agricultural skill.

The following considerations show clearly that in no case do the organic substances contained in the ground perform any direct part in the nutrition of plants. Humus, taken in its widest sense, is nothing more than the undecomposed parts of animal and vegetable substances. Before organic beings appeared on our earth, there could have been no organic mould; but even supposing such to have been the case, and in whatsoever degree, the earth must long since have been a wilderness had plants lived on organic matter. The organic substances which an animal devours are, to the extent of at least a half, entirely consumed by the process of nutrition; and the more or less rapid combustion of decomposition wherever life has ceased, raises the amount of complete destruction of organic matter to something quite enormous. The process of destruction may be estimated as follows:—For every rod of ground (containing 100 square feet) we may reckon at least 200 lbs. of destructible organic matter, of which 4 lbs., according to De Saussure's direct experiment, are changed into water and carbonic acid. Taking the surface of productive land in the whole earth, we have 3 millions of square miles, and thus 104 billions of pounds are annu-

ally destroyed. The destruction of organic matter by men and animals, according to the observations of Valentin, amounts to one billion annually. And supposing the consumption of fuel by each individual to amount in the year to one cord of wood, on data afforded by the consumption of Germany, without taking into account the extensive natural conflagrations which are so frequent and disastrous in many parts of the world, there is a consumption on this account of 40 billions of dry organic matter. The annual destruction then amounts to 145 billions. Now supposing the specific gravity of the matter on an average to be equal to that of water, we have 2¼ billions of cubic feet. And since the above mentioned surface contains 1164 billions of square feet, to satisfy the necessary conditions for the nutrition of the vegetable world, there must have been 5000 years back 10 feet deep of pure organic substance on its surface, supposing nutrition to be dependent on organic matter.

The following example will still further explain the author's views. In the year 1844 France possessed, according to statistical reports, 10,709,391 of the large animals, such as horses and beast, 30,859,454 of the smaller, as swine, sheep, calves, &c. Now if the daily annihilation of organic matter in the former case be reckoned at 11 lbs. per head, and that of the small at 3, the process of nutrition has entirely destroyed in the course of the year 76,789,000,000 lbs. of organic matter, that is six times more than the weight contributed by the whole mass of small and great taken together, reckoning the larger at 1000 lbs., the smaller at 600,* with 50 per cent. of dry organic matter. Now if we suppose that the other animals and plants of France contain 600 times as much organic matter, the whole organic material of the country would be consumed by the nutriment of the stock in a hundred years. And the application is easy to the whole universe.

It follows then that a process must exist for the sustenance of organic life upon the earth, in due proportion, which must be diametrically opposite to the process of nutrition in animals, and the consequent decomposition; and as that continually destroys organic matter and changes it into inorganic combinations, as water, carbonic acid, and ammonia, so this must form organic materials out of the inorganic elements. Since this process exists neither in the animal nor inorganic creation, it can be no other than the process of life and nutrition in plants; and if this is true generally, it is true of those plants which are the object of husbandry.

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* There must be some error in the numbers here, as an average of 60 would be nearer the truth. The principle, however, remains the same.

If we reflect again on the constant outgoing from an estate in various forms, and the extremely small quantity of matter which comes in to replace the expenditure, it is easy to see that all virtue would be extracted in a very short time from the land if plants depended, even in a small degree, only on the organic substances; whereas under good cultivation the ground is constantly improved in quality. Indeed, from the observations of the best authorities, it appears that the ground produces three times as much organic matter as it receives. But more than this, the greater part of the organic substance of manure cannot enter into the produce. The land is manured not for the year only, but for a series of years. By far the greater portion passes off by a silent process of decomposition, especially when the land is stirred, into the surrounding atmosphere. Not a tenth part of the organic substance of plants can possibly be supplied by the decay. There is, however, no ground to suppose that this tenth part arises from a different quarter from the remaining nine in cultivated plants, and the whole ten in a state of nature.

When it was stated above that plants of husbandry are distinguished by an alteration in the chemical process, this did not necessarily imply a change in quality. Wild plants form from water, carbonic acid, and ammonia, albumen, gluten, sugar, starch, oil, &c. The same substances are formed in cultivated plants; they do not form peculiar secretions, but merely store up some particular substance in excess.

Nor shall we find the matter weakened if the elements concerned in nutrition be severally examined. Oxygen and hydrogen need not be here considered, as they are amply supplied by water. Attention, therefore, may be confined to carbonic acid, nitrogen, sulphur, phosphorus, and the inorganic ashes.

1. Carbon is doubtless the most important constituent; it forms half the substance of the dry plant, and eight times as much as the nitrogen; the whole question therefore turns on the absorption of carbon. As in general the organic matter of the earth cannot supply the exigencies of the whole plant, so neither can it satisfy its demand of carbon.

Sugar plantations receive no manure in general, or at least merely the ashes of the spent canes. An acre produces 7500 lbs. of cane, the expressed juice of which contains at least 700 lbs., and the fragments of cane 500 lbs. of carbon. There is therefore an expenditure of 1200 lbs. of carbon per acre without any compensation.

The Oil palms grow in sand destitute of humus. Thirty-three million pounds of carbon are produced annually on ground free from organic matter in this way alone.

But the most striking instance is that of Bananas. An acre yields 98,000 lbs. of fruit a-year, which contains about 17,000 lbs. of carbon. For twenty years the harvest is repeated without any manure, and the ground, so far from becoming poorer, is every year more rich in humus, from the decay of the large juicy leaves.

But it may, perhaps, be as well to give some instances nearer home. The following table, by Boussingault, of plants grown in pure quartzose sand or burnt clay, with distilled water, is exactly to our purpose:—

	Weight.*	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Increase in Carbon.
Red Clover—						
Seed . . .	1,586	0,806	0,095	0,571	0.114	158 per Cent.
Produce. . .	4,106	2,082	0,271	1,597	0,156	
Peas—						
Seed . . .	1,072	0,515	0,069	0,442	0,046	361 per Cent.
Produce. . .	4,441	2,376	0,284	1,680	0,101	
Wheat—						
Seed . . .	1,644	0,767	0,095	0,725	0,057	89 per Cent.
Produce. . .	3,002	1,456	0,173	1,333	0,060	

In the first and third cases the experiment lasted 3 months, in the second 99 days.

Red Clover plants transplanted and similarly treated:—

	Weight.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Increase in Carbon.
When planted . .	0,884	0,384	0,048	0,419	0,033	212 per Cent.†
At the end of the experiment . .	2,265	1,200	0,145	0,863	0,056	
Oats taken up and placed in Distilled Water—						
Before experiment	..	0,827	0,106	0,568	0.059	81 per Cent.
After experiment	..	1,500	0,193	1,372	0,053	

* In this and the following table the weight is in grammes = ·564 dram. The proportions are the same whatever be the measure; we have thought it, therefore, needless to go through the labour of reducing them to English denominations.

† 156 per cent. in the text, which is clearly wrong, as is 18 per cent. in the next experiment, where the amount of carbon is set down as the weight of the plant.

The objection that carbon is necessary to supply the carbonic acid requisite for the early stages of vegetable growth, is fully answered by the fact that, if such were the case, it is amply supplied by the atmosphere to the water with which the plant is nourished, and that germinating seeds succeed for a time quite as well in moist quartz sand or cotton as in vegetable soil.

The only question which remains is, whether carbonic acid is really present in sufficient quantities to supply the demand. This, however, scarcely needs any answer, for by the process of decomposition and vital action the whole of the carbonic acid is returned to the atmosphere, so that it is a simple case of repeated circulation through plants, animals, and atmosphere; one generation gradually affording the material for another, even were there not other sources which we have no power of estimating.

But to set the matter beyond all doubt, the following calculation may be made :—

According to Link, Schwartz, and others, an acre of water meadow produces 4400 lbs. of hay, which, when dry, contains 45.8 per cent. of carbon. The hay then yields 2000 lbs. of carbon, to which 1000 lbs. may be added for the other portion of the year and for the roots. To produce these 3000 lbs. of carbon, 10,980 lbs. of carbonic acid are requisite, which may be raised to 12,000 lbs., to compensate for the nightly expiration. Now, according to Schubler, an acre of so wretched a grass as *Poa annua* exhales in 120 days (too low a computation) of active vegetation 6,000,000 lbs. of water. To supply the exigencies of the plants then, it is only necessary for it to imbibe 3½ grains of carbonic acid with every pound of water.

2. Nitrogen comes next in order. If there are soluble substances in the soil which could, if necessary, supply the requisite carbon, there are none to furnish the nitrogen. As soon, therefore, as it was ascertained that plants receive their nitrogen in the form of ammonia, it was generally allowed that organic nitrogenous particles of the soil must first, by decomposition, form ammonia before they can be available for nutrition. The question, therefore, as to the origin of the nitrogen of plants, assumes quite a different shape from that of carbon. There is no doubt as to the form in which it enters, but whether they depend in greater or less degree on the ammonia contained in the organic matter of the soil, or whether in this respect also they are independent of the organic substances of the soil, is matter of inquiry.

Now it is clear that the ammonia from the nitrogenous constituents of the soil is as available for vegetation as other ammonia, and that our domestic plants do not require a greater supply than in a state of nature. A water meadow which has

never received any dung yields yearly 40–50 lbs. of nitrogen, while the best ploughed land yields only about 31 lbs. The plants for which most dung is used, as potatoes and turnips, are in fact proportionally the poorest in nitrogen.

The vast Pampas of Buenos Ayres, since the introduction of horses and oxen, have yielded for their support almost incalculable quantities of nitrogen, millions of pounds being annually carried off in the form of hides, horns, &c.; and yet there is no decrease in the produce of the country, which must have been the case had the plants depended upon the soil for the requisite ammonia.

The Swiss Alps, the meadows of East Friesland and Holland, receive no organic nitrogenous matter, for the dung of the beasts which feed on them contributes always less than they have received. A horse, according to Boussingault, consumes in its food in 24 hours 78·6 drams of nitrogen; the excrement contains only 65 drams; 13·5 drams are given off by perspiration in the form of ammonia. In the cow the nourishment in the same time contains 113·7 drams, the nitrogen in the excrement and milk amounts to 98·4 drams, and that of the perspiration to 15·2 drams. In other words, the cow returns to the meadow for the 710 drams of nitrogenous organic matter which she consumes, only 614·7. Nevertheless, these alps and meadows contribute annually enormous quantities of nitrogenous matter in the shape of hay and cheese. This production of nitrogen must therefore be independent of the soil.

Another proof appears as follows:—Since the manure is intended for the supply of several successive years, the content of nitrogen in the crop, as the decomposition proceeds, must year by year regularly rise or fall. It is, however, quite independent of the time which may have elapsed since the manure was applied, as appears from the following table taken from Boussingault:—

	Nitrogen per Acre. lb.
Year 1. Potatoes	24,75
„ 2. Wheat	18,92
„ 3. Clover	45,21
„ 4. Wheat and stubble turnips	29,93
„ 5. Peas.	52,63
„ 6. Rye	17,43

In two five-year courses, and one of six years, the ground received yearly, per acre, 21·90 lbs. of nitrogen in dung. The excess of nitrogen in the produce over that in the dung was yearly—

		lb.
In the first 5 years' course	. . .	5,06
In the second	. . . .	5,45
In the 6 years' course	. . . .	9,83

According to De Saussure, nitrogenous substances are perfectly decayed in 88 days. But supposing the nitrogen supplied by the dung to be available for nutriment during the first year, yet after repeated ploughing every trace must have disappeared, and there would be no supply but for that which is absorbed from the air. Yet in the foregoing table we have the production of 18·92 lbs. per acre in the second year, and 52·63 in the fifth. If, then, 40 or 50 lbs. can be absorbed from the atmosphere when no dung is present, it seems absurd to suppose that 18 lbs. cannot be absorbed for the wheat and rye.

If we refer to the table at page 39, we shall see that the nitrogen was increased 37 per cent. in red clover grown in quartzose sand or burnt clay, with distilled water, in the course of 3 months only; while peas in 99 days gained 119 per cent., and wheat 5 per cent. In the last experiment, red clover transplanted into the same soil gained in 2 months about 70 per cent.

It remains only to inquire whether plants can derive sufficient ammonia from the air. As before, in the consideration of carbon, it may be remarked that plants and animals are momentarily giving out an immense quantity by the act of decomposition, and though we find but little in the atmosphere and in variable quantities, it must be recollected how easily and quickly it is absorbed by every porous body and by water so as to be at once available for nutriment. There is then a constant circulation of this element as of carbon, and there are other sources, as volcanoes and thunder storms, in which the hydrogen and oxygen arising from the decomposition of water pass into nitrate of ammonia, and the combination of free hydrogen with the carbon of the atmosphere. Lastly, by a consideration similar to that which was made with respect to carbon, it appears that $\frac{1}{13}$ of a grain of ammonia in every pound of water is sufficient for the exigencies of vegetation, and there is perhaps no spring water in the universe which contains so little.

3. The quantity of sulphur and phosphorus is so small that it is needless to enter into lengthened details. Peas, which yield 50 lbs. of nitrogen per acre, contain in the albumen 2 lbs. of sulphur and 1 of phosphorus. If the time of vegetation is spread over 120 days, and reckoning the height of the atmosphere at 3000 feet, only $\frac{1}{540000}$ of a grain of sulphuretted hydrogen and $\frac{1}{100000000}$ of a grain of phosphuretted hydrogen per cubic foot are requisite.

We have still to consider those inorganic substances which remain in the ashes when a plant is burnt.

It has been already seen that the inorganic or mineral constituents of the soil are of the most importance not only for plants in general, but for plants of husbandry. This is no new theory; it was broached by De Saussure in the last century; and even before Liebig reproduced it in a more perfect form, it had been acknowledged by Thaer and some other genial spirits. Notwithstanding all the great difficulties which are involved in the study of the inorganic constituents of plants, their importance is unquestionable; and when we compare the analyses of their ashes, conducted on the same uniform plan, the result is incontestable that different plants are distinguished by the quantity and quality of their inorganic contents. Unfortunately such analyses have been confined principally to plants under cultivation. But with differences of outward form and modifications of chemical action there must be great differences also of inorganic contents. We cannot indeed at present follow the intimate connexion between the process of vegetation and the inorganic constituents, yet the certainty of this connexion is beyond all doubt. Take what plant we may, we always find that with a different content in organic constituents there is a difference in the quantity of inorganic matters. We may refer to Boussingault's table of comparison of the nitrogen and phosphoric acid in plants: from this it appears that the proportion of phosphoric acid to nitrogen is tolerably constant; yet the phosphoric acid is in no general necessary proportion to the nitrogen. It is very probable therefore that phosphoric acid does not contribute directly to the formation of the nitrogenous parts, for albumen, gluten, and legumin contain nearly the same quantity of phosphorus, viz., about 0·3 per cent., although the proportion of phosphoric acid to nitrogen in the plants which afford gluten, as wheat, maize, and oats, is as 1 : 2·9; in the albuminous plants (as hay, potatoes, mangel wurzel, stubble turnips, and Jerusalem artichokes), as 1·35; and in those which contain legumin (as clover, beans, peas, and kidney beans), as 1 : 4·6.

It is self-evident that the inorganic constituents of plants are received from the soil in solution with water. It remains only to inquire what inorganic constituents are most important for domestic plants. They require indeed in kind the same as wild plants, but the question as to quantity is very different. They yield in general nearly twice as much of inorganic ashes.

Flint is mostly found in the walls of the cells in which it is deposited, and which it helps to strengthen; and the same may be said of a portion of the lime, which enters as a pectate into an insoluble combination with the gelatinous component of the cell

walls. We can form a notion of the content in silex from an examination of domestic plants, though silex is by no means characteristic of them, but rather of monocotyledons in general.

100 Parts of	Silex.	Mean.
Maize straw from Quartzose ground . .	9,74	8,24
„ from Transition lime . .	6,75	
Lolium perenne from Quartzose ground .	25,11	22,27
„ from Transition lime . .	19,43	

In dicotyledons the result is similar for lime combined with pectose.

The phosphates, as appears from a careful microscopic examination of the ashes, are found principally in the contents of the cells, and the easily soluble alkaline salts are diffused in the liquid matter. If then it is the inorganic constituents especially which modify the chemical action of plants, it must be in great measure the phosphates and alkalis, since this process takes place principally in the inside of the cells and their contained juices.

The flint and lime contained in the cells must have a constant and direct proportion to the quantity of cells and the mass of the whole plant; the phosphates and alkalis on the contrary rise or fall with modifications of the chemical action.

There are two circumstances especially in which wild vegetation is distinguished from that of our cultivated fields. 1st. In wild plants the departing generation is again incorporated with the ground. All the inorganic matters which they received from the soil return to it, and in the most favourable form. In cultivation, on the contrary, great quantities of inorganic matter, and that exclusively important for vegetation, are carried off with the plants themselves, and in consequence the soil must in a short time be exhausted if nothing be brought in in the shape of manure. 2ndly. Uncultivated ground becomes constantly richer in humus through the decay of the plants which it produced, and the more so because, in consequence of its never being disturbed, the decomposition of the humus is indefinitely prolonged, while cultivated land not only suffers from the removal of the crop, but what humus it contains is continually subject to decomposition by the frequent exposure of a new surface to the atmosphere. It may besides be mentioned that in cultivation, as the ground is covered by a crop consisting of one plant only, the inorganic materials are far less fully worked up than where the especial exigencies of multitudes of plants of different natures are to be supplied at one and the same instant.

There is, however, one more important circumstance to be mentioned before this part of the subject is closed, on which the dependence of agricultural plants on their soil actually rests. The geographical distribution of plants is determined by the con-

currence of all those conditions on which the success of any particular species depends. In general the peculiar kinds under cultivation in any given locality depend on the geographical distribution of the species.

Every locality in the more anciently cultivated parts of the Old World has some prevailing kind of bread-corn, that, viz. which yields the greatest produce in that particular district. If a line be drawn from the 56th degree of North latitude through Asia, gradually approaching the 60th degree passing through the Lake of Ladoga, and then almost to the 66th degree in Sweden—this line forms the southern limit of the first zone of cultivation. Part of the mountainous districts of Norway and Scotland belong to this zone. North of this line, as far as cultivation extends towards the Pole, Barley, in some one of its forms, is the peculiar bread-corn, and Rye is cultivated only in favourable situations. A second line runs through Asia almost coincident with the 51st degree, retiring in Russia and Germany a little below 50°, proceeding through Holland and through the north of England and Ireland. Between this and the former line Rye is the staple corn, mixed here and there in favourable localities with Wheat. Both these regions have besides a plant of a different order producing flour, especially in the northern half of the Rye zone, viz., Buckwheat. In the south of England, the north of France, the middle of Germany to the Alps, the north of Turkey, the south of Russia, and from thence through Asia in a broad zone to Persia and Thibet, Wheat is the bread-corn, with Rye intermixed in rough mountainous districts. Finally, the whole circuit of the Mediterranean Sea produces Wheat and Maize almost in equal quantities. The environs of the Red Sea, the north coast of the Indian Ocean, and the north of India yield Wheat and Rice in pretty equal proportions; and finally in the two Indian Peninsulas, China, and Japan, Rice is the exclusive staple.

In all the northern districts the cereals are notoriously introduced plants which would vanish entirely in all parts of Europe at least, without cultivation. Their presence and their geographical distribution in those countries affirm nothing more than that they have found there suitable conditions of climate. Even supposing them to be indigenous, the cessation of their cultivation would cause them to disappear except from some very confined district. The distribution of plants does not depend alone on conditions of climate. We have in cultivation to provide certain conditions which nature has not provided in the field of our exertions, while wild vegetation needs no such artificial help, since plants in nature do not grow where the conditions necessary for their existence are not present.

We stop here for the present with the intention of returning to the subject in a future number. We have shown what are the author's notions as to what manure will not do—we are next to see what it really is calculated to effect.

IV.—*On Spiræa prunifolia flore pleno and Forsythia viridissima in the United States.* By John Saul, Washington, D.C.

(Communicated November 11, 1851.)

Some idea of the beauty and condition of these plants in this country may perhaps be gleaned from the following observations:—

Spiræa prunifolia flore pleno.—When this plant first made its appearance in England, and in some parts of the continent of Europe, it was hailed as a great acquisition. It will be recollected that Mr. Fortune sent it from China to the Horticultural Society's Garden at Chiswick, and that Mr. Van Houtte had it from Dr. Van Siebold. It was let out from Ghent at a high price, and its sale I presume must have been extensive; for it was soon scattered over England in all directions. Nevertheless, how few have been successful in cultivating it! I have known parties in England who had fine plants which they never bloomed well! Now, what were the causes of failure? Let us examine how such subjects had been managed, and we shall probably discover something like a cause. The plants in England, if grown in pots, were probably placed in a tolerably shady situation; if planted in the open ground, a piece of well prepared soil and sheltered situation were chosen for them: under both these circumstances they grew well, and apparently matured their wood; I say apparently, for when blooming time came, we had green abortions, called flowers. Now, if we inquire into the nature of the native climate of this plant, we shall soon perceive the cause of so much disappointment with it in England. If I describe the climate of the Middle States of this country, I shall, I apprehend, very nearly represent its natural conditions; here this plant is perfectly hardy, enduring a very low temperature. The springs are warm, followed by intense summer heat, with bright light; autumn is also bright and warm. Under these circumstances the wood acquires a firmness and maturity which it never attains in England. In the latter country, when ripe, it has at best a greenish hue, very different from the brown rigid appearance which it acquires in America. Spring comes, and

with it a profusion of bloom of snowy whiteness, precisely like the flowers of Ranunculus aconitifolius, but smaller; it is in no way particular as to soil, but dry rather than moist earth appears to suit it best. From its success here, it is evident that in England it would require a well-drained soil and an open, airy situation, where it would receive all the sun and light which the climate can give, so as to get the wood thoroughly and perfectly ripened by autumn: this secured, a good bloom is certain.

For forcing, this plant is invaluable; for this purpose specimens grown in pots should be placed in a sunny situation, in order to mature their wood well; if this is not attended to, failure will ensue. I have observed in some of the forcing houses in this country, that when the plants had been kept too warm, in too dark a house, or the atmosphere over moist, green flowers were the result, and in some instances no flowers at all. Now, if this will happen in a climate like that of the Middle States, where the wood had been well ripened, how much more likely is it to occur in England, where the wood is never half matured, and the plants in that state transferred to a warm dark forcing-house, at a season when there is little sun! There are few plants more deserving of care or attention than this, whether employed in ornamenting the shrubbery in spring, or the conservatory and green-house at an early season. How very necessary it is that we should know the latitudes from whence plants come, in order to be able to treat them properly! How frequently is every method but the right one tried!—soil, situation, frequently too much heat. Had more of the beams of the sun been permitted, all would have been well.

Forsythia viridissima.—The value and exquisite beauty of this plant are not, I fear, sufficiently known in England, where by many it is only considered a second rate subject. When Mr. Fortune introduced it to the Garden of the Horticultural Society from China, he spoke in high terms of its beauty, and I question much whether any thing more handsome can be found among all his introductions, not excepting even the lovely Weigela rosea. It has qualities which the latter does not possess, and which must ever render it one of the most valuable of hardy plants. From specimens which I had an opportunity of inspecting in England,* I entertained a doubtful opinion of its merits. What was my surprise last March, however, when I beheld a magnificent bush of it in the nursery of A. Saul and Co., Newburgh, New York, covered with myriads of its deep yellow blossoms! The nursery in question is situated in the highlands of the Hudson, with that

* Some persons may have been successful in cultivating it there, but no really fine plants ever came under my notice in that country.

noble river flowing by their base, and open to a cold breeze from the north, especially in winter, during which time the constitutional hardiness of plants can be well tested. The soil in which it grows is a gravelly loam; the plant is about 5 feet high, very bushy, and it appears to have been planted two or three years. During the summer of 1850 it made shoots from 3 to 4 feet long, which, though strong and gross, were well ripened in the autumn The bright light and burning heat of an American sun consolidate the wood as it elongates during summer. Autumn arrives, fully as warm as an English summer, and much drier. This perfects what remains of the ripening process, and enables the plant to endure the winter unprotected, through a degree of cold which has no parallel in Britain. About the middle of March it commences opening its blooms, which had been thickly set over the wood of the previous year, and by the end of the same month it is one complete mass of deep yellow. Its season of flowering will of course depend on the latitude in which it is grown: here it commenced opening its blooms on the first approach of fair weather, and while the snow still lay thickly on the ground. Compared with other early flowering plants, it was decidedly ahead of all of them. Even the early Pyrus (Cydonia) Japonica had scarcely commenced expanding its flowers when the Forsythia was in full beauty. In the 1st Vol. of the 'Gardener's Magazine of Botany,' p. 249, occurs the following passage:—"Unfortunately the flowers are too delicate in texture to bear exposure to rough wind, as they are readily bruised and soon show the effects of rough treatment; but planted and trained against a wall, or in a very sheltered situation, it will be found a useful and excellent plant." So far is this from being correct, that I know of no plant whose blooms will bear an equal amount of "rough treatment" uninjured. The subject of my remarks here was fully three weeks in bloom, during which time it encountered one or two falls of snow and much wet weather, yet the blooms did not appear discoloured in the least up to the time they dropped off, and the ground was literally covered with them. The plant was in an open, exposed situation. In order to grow this plant well in England, we must examine the causes to which success is to be attributed in the case just cited. It was not soil; for that in which the plant was placed was rather of a poor description, and I observed other plants in the same nursery growing vigorously in earth of the poorest kind. Bright light and intense heat are the conditions to which success was owing; for the plants were luxuriant and happy, such as we might expect to have seen them in their Eastern home. In England, no doubt, the best situation for it would be against a south wall, where it would receive all the sunlight possible; so circumstanced, it

would ripen its wood well and yield abundance of flowers in early spring, or more probably in the mild climate of England it would bloom like the Cydonia Japonica, Chimonanthus fragrans, the greater part of the winter. Planted out as a bush, an open, airy situation should be chosen, where it would receive the direct rays of the sun all day; in all cases it should be guarded against overmuch moisture at the root: let the soil in which it grows be rather dry than otherwise. In this way the wood would ripen well in autumn, and would be followed by an abundant bloom. The work from which I have already extracted considers it a very useful plant for winter and spring forcing, an opinion in which I entirely concur.

In order to grow this plant for winter blooming in the conservatory or green-house, take strong young plants in the spring; shift them liberally, using any good compost; stop the plant to cause it to break into several shoots—as it is rather inclined to throw one or two strong branches. As the plants progress in growth they should be shifted occasionally, and frequently stopped; the best way of effecting this is, as soon as any shoots are observed to grow longer than the others, to pinch out the extreme points; they will soon break freely: whereas if left till the wood becomes firm and then shortened, they take a longer time to break, and they never do it so freely. When the plants have completed their growth, let them be placed in an open, sunny situation,—they cannot possibly be too much in the blaze of the sun:—here they should remain until autumn arrives, when they may be plunged in any convenient situation. As the plants are required to bloom they may be introduced into the forcing-house, or what in my opinion is better and quite sufficient for the purpose, a warm green-house, placing them in the most sunny part of it. In a house of this description the blooms would come deeper in colour; it is well known how pale and washy such colours are out of the confined atmosphere of a forcing-house. Whether used for the latter purpose, or grown in the open border, as I have already stated, I consider this plant one of the most valuable of Mr. Fortune's introductions. The Weigela, though extremely beautiful, blooms at a season when many other things are in flower, whilst the Forsythia blossoms when every stray floret is welcome.

Note.—The Weather Register at Shanghae given in the following pages will materially elucidate the question of what climate does for these two plants.

V.—*A Register of the Weather at Shanghae for Nine Months of the Years* 1850–51.

The large number of plants now in our gardens from those Chinese provinces the climate of which may be practically regarded as illustrated by that of Shanghae, has suggested the propriety of printing, from the columns of the *North China Herald* newspaper, a pretty complete record of the weather there for two years from the beginning of November to the end of July. Hereafter, if the paper should continue to reach England, the three remaining months may also be given, with such remarks as the facts mentioned in the Register may seem to call for. In the mean while it is sufficient to point out the fact that the Camellia, the Chinese Azalea, the Tea-plant, the Cryptomeria, and numerous other shrubs, find themselves at home in the climate here described.

Week ending 7th November, 1850.

Nov.	Barometer.		Thermometer		Wind.		Rain.	
	1850	1849	1850	1849	1850	1849	1850	1849
1	30·12	30·46	66·	61·	N.W.	N.E. to E.S.E.	0·38	..
2	30·16	30·35	65·5	65·5	N.W.	S.S.E.	0·03	..
3	30·27	30·39	58·	63·5	W.N.W. to N.W.	N.N.W. to N.	0·24	..
4	30·23	30·38	59·	64·5	S.W. to N.W.	N.E.	0·04	..
5	30·36	30·36	58·5	63·5	N.W. to N.E.	E.S.E.	..	..
6	30·42	30·35	58·5	63·5	E.N.E. to N.E.	E.S.E. to N.W.	..	0·27
7	30·30	30·51	60·	59·5	N.W.	N.N.E.	0·08	0·31
						Total .	0·77	0 58

Obs.—Since the commencement of the month the weather has been unusually wet and disagreeable—although the actual amount of rain fallen is not above the average of the last three years. The quantity of early wheat appearing above the surface in the numerous fields in which it has been sown, gives the country a fresh look, contrasting pleasantly with the brown withered plants of the cotton.

Week ending 5th December, 1850.

Nov.	Barometer.		Thermometer		Wind.		Rain.	
	1850	1849	1850	1849	1850	1849	1850	1849
29	30·49	30·50	46 5	54·	N.W.	N.N.W. to N.E.	..	..
30	30·58	30·34	47·	61·5	N.W. to N.N.E.	S.S.E.	..	..
Dec. 1	30·56	30·36	48·	65·	E. to N.E.	S.	..	..
2	30·46	30·43	49·	52·	N.W.	N.	..	..
3	30·35	30·42	45·5	50·	N.W.	N. to E.N.E.	..	0·02
4	30·50	30·33	42·5	55·5	N.W.	E.	..	0·24
5	30·48	30·18	43·	62·	N.N.W. to W.	S.S.E. to N.W.	..	0·01
						Total .	..	0·27

Obs.—Nothing could be finer than the weather of the last week, with its clear sky and bracing frosty mornings, although the mercury in the thermometer has stood higher than last week. The average height of the thermometrical column this week will be observed to be 45·9, or 11·2 below the average of the corresponding week in 1849—a week of remarkable heat, accompanied by unsteadiness of the barometer, and followed by some of the coldest weather experienced during the year.

Week ending 12th December, 1850.

Dec.	Barometer.		Thermometer		Wind.		Rain.	
	1850	1849	1850	1849	1850	1849	1850	1849
6	30·46	30·36	45·	49·5	N.W. to N.N.W.	W.N.W. to N.W.	..	0·08
7	30·46	30·52	40·5	43·5	N.N.E. to N.E.	N.N.W.	..	..
8	30·52	30·58	43	46·	E. to E.S.E.	N.N.E. to N.E.	..	..
9	30·38	30·59	49·5	50·5	E.S.E. to S.E.	N.E. to E.S.E.	..	0·01
10	30·42	30·59	55·5	48·5	E.S.E.	NNE. to NNW.	..	0·08
11	30·37	30·58	59·5	40·5	E. to S.E.	N.N.W.	..	..
12	30·22	30·11	60·5	42·5	S.E.	N. to E.	..	..
						Total .	..	0·17

Obs.—The weather of the last week has been uncommonly fine, with an average temperature ranging 4·7 above that of the same week last year. This day has been particularly warm, exceeding the heat of any day in the corresponding week of 1849 by 10 degrees. The wheat and bean crops look so far advanced as to cause some doubts as to the consequences to them of a hard frost.

Week ending 19th December, 1850.

Dec.	Barometer.		Thermometer		Wind.		Rain.	
	1850	1849	1850	1849	1850	1849	1850	1849
13	30·36	30·19	54·5	51·	N.N.E. to N.E.	W.	0·03	0·01
14	30·31	30·30	51·5	48·5	N.W.	N.W.	0·07	0·29
15	30·49	30.57	43·	39·5	N.W.	N.N.W.	0·23	0·01
16	30·54	30·55	42·5	40·	N.N.E. to N.E.	N.W.	..	..
17	30·40	30·53	47·5	38·5	N.E.	W. to W.N.W.	..	..
18	30·52	30·51	47·	40·	N.W. to N.	E.N.E.	..	..
19	30·50	30·46	45·5	47·	N.E.	W. to E.N.E.	..	..
						Total .	0·33	0·31

Obs.—The past seven days have been rather unseasonable—the first half being wet, and the latter half unsettled. The average temperature of the week ranges 3·8 above that of the corresponding week last year. The surrounding country looks peculiarly bleak; and its unvaried flatness is perhaps never more apparent than at this season, when the trimming of the hedges and the cutting down of the reeds from the tombs and banks of the canals removes any appearance of undulations that it may have presented before.

Week ending 26th December, 1850.

Dec.	Barometer.		Thermometer		Wind.		Rain.	
	1850	1849	1850	1849	1850	1849	1850	1849
20	30·57	30·43	41·5	45·	N. to N.N.W.	N.N.E. to N.W.	..	..
21	30·61	30·33	39·	47·	N.W.	E.N.E.	..	..
22	30·54	30·19	36·5	51·5	N.W.	E.	..	0·08
23	30·52	30·43	37·5	47·	N.W.	N.N.W. to N.W.	..	0·15
24	30·50	30·37	39·	45·	S.W. to N.W.	W.N.W.	..	..
25	30·54	30·23	40·	45·	N.W.	S.S.E.	..	..
26	30 61	30·44	33·	46·5	N.W.	N.N.E.	..	..
						Total .	..	0·23

Obs.—The atmosphere during the past week has been very much such as would be experienced in England during the Christmas week, although scarcely so cold. For the last seven days the frost has been almost uninterrupted; the thermometrical column averaging 38°, a

fall below the temperature of the same week last year by 8·7. The peasants have taken the precaution of protecting their wheat and other crops by sprinkling earth loosely over them.

Week ending 2nd January, 1851.

Dec.	Barometer.		Thermometer		Wind.		Rain.	
	1850	1849	1850	1849	1850	1849	1850	1849
27	30·48	30·60	38·5	37·	W. to N.W.	N. by W.	..	..
28	30·46	30·52	42·5	36·	N.E.	W. to S.S.E.	..	..
29	30·41	30·28	42·5	44·	N.E.	S.W. to W.	..	..
30	30·36	30·48	42·5	39·	S.	W.N.W.	..	..
31	30·35	30·40	47·5	41·	S.W.	S.	..	..
Jan.	1851	1850	1851	1850	1851	1850	1851	1850
1	30·32	30·19	47·5	56·	S.W.	S.	..	..
2	30·27	30·49	52·5	36·	S.	N.N.W. to N.W.	..	0·05
						Total .	..	0·05

Obs.—The last week has been one of beautiful weather, although much warmer than the preceding week. The average temperature has been 44°, while that of the corresponding week last year was 41·2. During the last few days there has been no frost.

Week ending 9th January, 1851.

Jan.	Barometer.		Thermometer		Wind.		Rain.	
	1851	1850	1851	1850	1851	1850	1851	1850
3	30·26	30·47	47·5	33·	N.W.	W.N.W. to W.	..	..
4	30·54	30·46	41·5	35·5	N.	W. by N. to NNW.	..	..
5	30·44	30·22	41·5	37·	N.E.	S.	..	..
6	30·30	30·27	41·5	41·5	N.W.	S. to S.E.	0·22	..
7	30·37	30·21	35·5	44·	N.W.	N.N.W. to N.	0·30	..
8	30·40	30·26	35·	40·	N.W.	N.N.E.	..	..
9	30·54	30·24	32·5	39·5	N.W.	N.E. to E. by N.	..	0·05
						Total .	0·52	0·05

Obs.—The first part of the last seven days continued fine weather;

Monday and Tuesday being damp and disagreeable, followed on Wednesday and to-day by hard frost. The average temperature of the week has been very nearly that of the corresponding week of last year; in 1850 the mercury standing at 38·6°, and during the past week at 39·2°.

Week ending 16th January, 1851.

JAN.	BAROMETER.		THERMOMETER		WIND.		RAIN.	
	1851	1850	1851	1850	1851	1850	1851	1850
10	30·48	30·25	37·5	40·5	N.W. to N.E.	N.N.E. to N.	..	0·04
11	30·43	30·39	37·5	34·5	N.W.	N.N.W.	..	0·03
12	30·53	30·44	35·5	32·5	N.W.	NNW to NW by N	..	..
13	30·52	30·38	35·	31·5	W. to N.E.	N.W. to N.E.	..	..
14	30·56	30·42	39·5	31·5	N.E. to E.	N.W.	..	..
15	30·39	30·52	42·5	33·	S.E.	N.W. by N. to N.	..	..
16	30·15	30·45	48·	37·5	S. to W.	N.W. by N. to N.	..	..
						Total .	..	0·07

Obs.—The weather of the past week has been fine up to to-day, when it changed from a bracing frosty to a misty hazy atmosphere, accompanied by temporary passing showers of drizzling rain. The average temperature of the week has not ranged so low as the average of the corresponding week last year by 4·9°; that of 1850 being 34·4°, that of the present year 39·3°.

Week ending 6th February, 1851.

JAN.	BAROMETER.		THERMOMETER		WIND.		RAIN.	
	1851	1850	1851	1850	1851	1850	1851	1850
31	30·51	30·50	41·5	32·	E.	N.N.W.	0·07	..
Feb. 1	30·52	30·44	41·5	33·	N.E.	N.W. to E.N.E.	..	..
2	30·64	30·34	39·5	40·	N.W. to N.	W.S.W.	..	..
3	30·60	30·62	38·5	40·	N.E.	N.W. to N.N.W.	..	..
4	30·55	30·58	39·	37·	N.E. to N.W.	N.N.W. to N.	0·01	..
5	30·56	30·70	41·5	37·	N.W. to N.	N.E. to N.	..	..
6	30·53	30·52	37·5	46·5	N.W.	S.E. to E.S.E.	..	..
						Total .	0·08	..

Obs.—The weather of the last week has not been so clear and bracing

as we might have expected at this season of the year. A slight fall of snow took place on Monday night, which gave a wintry look to the country on Tuesday morning, until the sun heated the ground. Another slight shower occurred early on the morning of Wednesday, but did not lie on the ground. The thermometer has not sunk so low during this week as during the corresponding week of last year by 1·9°; the average in 1850 being 37·9°, and in the past week 39·8°.

Week ending 13th February, 1851.

Feb.	Barometer.		Thermometer		Wind.		Rain.	
	1851	1850	1851	1850	1851	1850	1851	1850
7	30·27	30·45	45·	42·5	S.W. to N.W.	N.W.	..	1·43
8	30·41	30·78	42·5	30·	N.	N.W. to W.N.W.	..	0 03
9	30·49	30·77	42·5	31·5	N.W.	W.N.W. to W.	..	..
10	30·31	30·53	40·	37·5	S.E.	S. to E.	..	..
11	30·06	30·37	44·5	41·5	N.W.	S.S.E. to E.N.E.	..	..
12	30·20	30·48	45·	44·5	E.	N.W. to N.	..	..
13	30·14	30·43	44·	43·5	N.E.	E.N.E.	0·54	..
						Total .	0·54	0·46

Obs.—Since our last observations the weather has been fine during three days, accompanied by frost each night; this has been succeeded by a less promising state of the atmosphere, and yesterday and to-day have been damp, disagreeable, and rainy. At the same time, compared with the corresponding week last year, the temperature has been higher by 4·6°; the average of 1850 being 38·7°, and of the past week 43·3°.

Week ending 20th February, 1851.

Feb.	Barometer.		Thermometer		Wind.		Rain.	
	1851	1850	1851	1850	1851	1850	1851	1850
14	30·21	30·49	42·	43·	N. to N.W.	N.E. to N.N.E.	0 22	1·27
15	30·36	30·47	42·5	43·	N.W. to E.	N.E.	..	0·14
16	30·28	30·46	41·	40·	N.E.	NNE. to NNW.	0·52	0·09
17	30·50	30·40	36·5	38·5	N.W.	NNW. to WNW.	..	0·29
18	30·53	30·40	36·	37·	N.W.	N.W. to E.S.E.	..	..
19	30 48	30·49	38·5	42·5	S.E.	N.W. to W.N.W.	..	0·02
20	30·27	30·69	41·	32·	S.E. to N.	N.W. to W.N.W.	0 37	..
						Total .	1·11	0·81

Obs.—In the course of the last seven days the weather has been very variable—rain having fallen in three of them. The temperature has very slightly exceeded that of the corresponding week last year; the average of 1850 being 39·4°, and of the past week 39·6°.

Week ending 6th March, 1851.

Feb.	Barometer.		Thermometer		Wind.		Rain.	
	1851	1850	1851	1850	1851	1850	1851	1850
28	30·47	30·47	46·5	47·	N.E.	N.E.	..	..
Mar. 1	30·56	30 48	43 5	45·	S.E.	N.N.E.	..	0·12
2	30 21	30·60	47·5	42·	S.E. to N.W.	N.N.W.	0·30	0·20
3	30·31	30·68	47·5	42·	N. to S.E.	WNW. to NNW.	0·03	..
4	30·19	30·67	49·5	46·	N.E.	N.	0·40	..
5	30·38	30·54	49	47·	N.W.	S. to S.E.	0·04	..
6	30·61	30·46	31·5	42·5	N.W.	N.W. to N.N.E.	..	..
						Total .	0·77	0·32

Obs.—The weather of the past week has been on the whole fine; the last two days have been cold. On Tuesday night and Wednesday night the wind blew very strong from the N.W., but subsided to-day. The average height of the thermometer has been 45°.

Week ending 13th March, 1851.

March	Barometer.		Thermometer		Wind.		Rain.	
	1851	1849	1851	1849	1851	1849	1851	1849
7	30·39	30·68	35·5	46·	E. to N.W.	N. to N.N.E.	..	..
8	30·09	30·72	50·	48·5	N.E. to N.W.	NE. to NE. by E.	..	..
9	30 45	30·54	51·5	52·5	W. to S.W.	S.S.E. to S.W.	..	..
10	30·21	30·53	52·5	52·	S.E.	O.	..	0·03
11	30·24	30·58	53·5	53·	S.E.	N.E. by E.	..	..
12	30·27	30·33	56·5	52·5	S.E.	S.E.	0·05	..
13	30·25	30·23	49·5	49·5	N.E.	W. to W.N.W.	0·15	0·89
						Total .	*0·20	0·92

Obs.—The past week has been dull and overcast, rain having fallen during the evenings of the last three days. On the afternoon of the 9th

* Exclusive of 1·46 fallen up to 9 o'clock this morning.

and 10th the sun presented a remarkable leaden hue as seen through the misty atmosphere. The average height of the thermometer has been 49·8°.

Week ending 20th March, 1851.

March	Barometer.		Thermometer		Wind.		Rain.	
	1851	1849	1851	1849	1851	1849	1851	1849
14	30·19	30·47	48·5	48·5	N.E.	N.N.W.	1·46	0·02
15	30·29	30 64	49·	44·	N.E.	WSW.toNW.byN	0·18	..
16	30·33	30·59	47·	50·	S.E.	S.S.E. to S.E.	..	..
17	30 32	30·54	47·	56·	S.E.	E.N.E.	..	..
18	29·95	30·46	54·	56·5	S.E. to S.W.	E.N.E. to S.E.	0·02	..
19	30·07	30·33	35·5	53·5	N.	S.E.	0·55	..
20	30·22	30·39	53·	47·5	N.E.	S.E.	..	..
						Total	2·21	0·02

Obs.—The weather of the past week has been much overcast. On Tuesday, although the average temperature did not exceed 54°, with the Barometrical column standing at 29 90 in., a feeling of oppression was generally experienced, until the atmosphere was cleared by a violent thunderstorm accompanied by much rain, which commenced shortly after 11 A.M., and in the course of which the unfortunate barque *Alverton* was struck by the electric fluid on the head of the fore-top-gallant mast. The crops are in full vigour and look promising. The average height of the thermometer has been 50·3°; in 1849 it was 52·2° for the corresponding week.

Week ending 27th March, 1851.

March	Barometer.		Thermometer		Wind.		Rain.	
	1851	1849	1851	1849	1851	1849	1851	1849
21	30·15	30·31	49·	55·5	N.E. to S.E.	S.E.	..	..
22	30·02	30·15	49 5	56·5	S.E. to N.W.	W.S.W.	0·31	0·48
23	29·99	30·42	51·	57·	N.E. to N.	N. to N.E.	0·24	0·05
24	30·24	30·38	46·	60·	N.	S.E.	0·12	..
25	30·41	30·15	47·	55·5	N.W.	S.S.E. to S.E.	0·23	..
26	30·28	30·19	44·5	59·5	N.W.	N.N.W.	..	0·05
27	30·33	30·25	47·5	60·	N.W.	S.E.	0·50	..
						Total .	1·40	0·58

Obs.—The almost incessant rain of the last week has been of much use to the crops, which will only be benefited by it should it not be of much longer continuance. The sun of to-day caused the exhalation of an exquisite aroma from the bean fields, differing very materially from that which usually greets the nostrils of the passer by. In consequence of the clouded weather the thermometer has not indicated a heat equal to the average at this season. During the past week the average has been 47·8°, and during the corresponding week of 1849 it attained 57·7°.

Week ending 3rd April, 1851.

March	Barometer.		Thermometer		Wind.		Rain.	
	1851	1849	1851	1849	1851	1849	1851	1849
28	30·36	30·22	50·5	64·	N.E.	S.S.W. to N.E.	..	..
29	30·40	30·25	53·	59·5	S.E.	E.N.E. to S.E.	..	..
30	30·09	30·19	58·5	57·5	S.E.	N.E.	..	0·41
31	29·97	30·00	58·5	60·	N.W.	W.N.W.	0·08	0·56
Apr. 1	30·20	30·21	51·5	55·5	N.W.	N.W. to W.N.W.	0·87	0·58
2	30·17	30·54	50·5	44·	S.E.	N.N.W. to N.W.	0·08	0·01
3	30·20	30·62	51·	48·	N.E.	N. to N.W.	0·40	..
						Total .	1·43	1·66

Obs.—Although much rain has fallen, and, with the exception of Saturday, although we have scarcely seen the sun during the last week, the crops continue uninjured and promise well. Several fields of early wheat have been observed in ear. During the past week the average height of the thermometer has been 53·3°; during the corresponding week of 1849, 55·5°.

Week ending 10th April, 1851.

April.	Barometer.		Thermometer		Wind.		Rain.	
	1851	1850	1851	1850	1851	1850	1851	1850
4	30·48	30·42	48·	54·5	N.E. to N.N.E.	NNW. to WNW.	0·40	0·39
5	30·42	30·46	45·	55·5	N.W.	NW. to NNE.	0·36	..
6	30·35	30·59	51·5	54·5	S.E.	WNW. to NNE.	..	..
7	30·20	30·37	55·5	54·	N.W.	S.S.E.	0·12	..
8	30·09	30·21	58·	61·	S.E.	S.S.E.	..	..
9	30·05	30·16	57·5	66·	N. to N.E.	S.S.E.	0·22	..
10	29·96	30·23	57·5	66·5	S.	S.S.E.	..	..
						Total .	1·10	0·39

Obs.—Rain has fallen on almost every evening of the past week. A considerable shower of snow fell on the night of the 4th, since which vegetation has advanced rapidly. All the barley and some additional fields of early wheat are now in ear. The bean fields are magnificent; in one the stalks measured fully three feet in height. The willow and several other trees are now covered with foliage, and many flowers in full bloom show us that summer is fast approaching. The thermometer attained an average of 53·2° during the past week; in 1850 the average was 58·2°.

Week ending 17th April, 1851.

April.	Barometer.		Thermometer		Wind.		Rain.	
	1851	1850	1851	1850	1851	1850	1851	1850
11	29·92	30·10	62·	59·5	N.E. to S.W.	N.W.	..	0·72
12	29·81	30·05	63·5	58·	S.	W.N.W.	..	0·08
13	30·06	30·14	62·5	61·	N.W.	N. to N.N.W.	..	..
14	30·05	30·05	55·	61·	N.E.	S.E.	0·47	..
15	30·24	29·88	55·	66·	N.E.	S.S.W. to S.S.E.	0·44	..
16	30·30	29·94	50·	60·5	N.E.	N.W.	0·08	0·24
17	30·43	30·15	55·	54·5	N.W.	N.N.E. to N.E.	0·50	0·65
						Total .	1·49	1·69

Obs.—Although much rain has fallen during the past week the crops continue to look very promising. In the vicinity, to the north of Shanghae, a field of oats, an unusual sight, was observed in full ear. The average temperature of the past week has been only 57·5°; the corresponding week in 1850 having an average of 60°.

Week ending 24th April, 1851.

April.	Barometer.		Thermometer		Wind.		Rain.	
	1851	1850	1851	1850	1851	1850	1851	1850
18	30·49	30·29	57·	60·5	S. to S.E.	N.E.	..	..
19	30·16	30·35	57·5	54·5	S.E. to N.W.	N.E.	0·10	..
20	30·07	30·28	57·	58·	S.	N.E.	..	..
21	30·00	30·24	60·5	63·	N.W. to N.E.	N.N.E. to N.E.	0·47	..
22	30·01	30·25	58·	63·	S.	E.N.E. to E.	..	..
23	30·02	30·22	58·5	66·	N.E.	N.E. to E.S.E.	2·40	..
24	30·10	30·15	55·	63·5	S.E. to E.	E.S.E. to S.S.E.	0·08	..
						Total .	3·05	..

Obs.—The continued fall of rain during the past week, although not up to this time of essential damage to the crops, it is much feared by the Chinese will produce an injurious effect, from the continued moisture of the ground leading to mould, smut, &c. Several fields of a species of Brassica (?), used by the Chinese in the preparation of oil, are now in full bloom, and impart a delightful fragrance to the surrounding atmosphere. The average temperature of the week has only attained 57·6; of the corresponding week last year it was 61·2°.

Week ending 1st May, 1851.

April.	Barometer.		Thermometer		Wind.		Rain.	
	1851	1850	1851	1850	1851	1850	1851	1850
25	29·79	30·02	56·5	75·5	E.S.E. to S.S.E.	S. to S.S.E.	0·80	..
26	29·88	30·11	55·5	52·5	W.N.W. to N.W.	N.N.E.	0·40	0·40
27	30·12	30·27	61·	63·	E.	N.W. to N.	0·04	0·70
28	29·87	30·21	60·	62·	S. to S.S.E.	N.N.E. to E.	..	..
29	30·01	30·09	58·	67·5	N.W. to N.N.W.	S.E. to W.	0·47	..
30	30·08	30·18	55·	68·	S.S.E. to S.E.	N.W. to W.N.W.	..	0·09
May 1	30·11	30·28	56·	69·	S.S.E.	S.S.W. to S.S.E.	0·03	..
						Total .	1·74	1·19

Obs.—The weather has continued disagreeable during the last week up to to-day. The wheat crops do not seem to have suffered materially from the continued wet otherwise than by the undue development of the stalks, and consequent deficiency in that of the ears; the grains are now forming rapidly. The beans are healthy; in many places the pods have attained a length of three inches, containing seeds two lines in their greatest diameter. The peasants were observed yesterday for the first time scattering cotton seed among the wheat, to be ready to take the place of the latter crop when cut down. The average temperature during the past week has been 57·4°; during the corresponding week of 1850 it attained an average of 65·3°—an excess of heat over the present season of no less than 7·9°. On comparing the range of the thermometer during the whole of April in both years, it will be found that the average of 1850 was 59·4°, while it has only attained to 55·6° in the present year.

Week ending 8th May, 1851.

May.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
2	30·18	30·34	30·04	62·	72·	E.	S.S.E.	..	..
3	30·04	30·20	29·95	56·	71·5	S.E.	S.S.E.	0·28	..
4	30·12	30·00	29·98	61·	73·	N.N.E. to S.E.	S.	0·17	..
5	30·20	30·01	30·02	63·5	79·	S.E.	W.N.W. to N.E.	..	0·01
6	30·04	30·07	30·05	58·	71·5	S.E. to S.	E.S.E. to S.E.	..	..
7	30·12	30·00	29·98	65·5	75·	E.S.E.	S. to S.S.E.	0·01	..
8	30·10	30·21	29·96	64·	57·5	S. to S.W.	N.E.	..	0·60
							Total .	0·46	0·61

Obs.—A considerable change for the better has taken place in the weather of the past week, and with it the surface of the country has in many places undergone a complete metamorphosis. In numerous fields the crop of beans has been ruthlessly pulled up by the roots and either dug or ploughed into the ground for manure, grown apparently for no other purpose. Those fields intended for the future growth of paddy have been irrigated by the numerous chain pump machines in the construction of which the Chinese display so much ingenuity. During the last few days the peasants have been busy in treading with their feet and by means of buffaloes the irrigated fields, and in one or two parts have sown that portion of the grain intended for subsequent transplantation. Although yesterday the thermometer placed in the sun indicated a temperature of 110°, the average of the whole week has been less than that of the corresponding week last year by 9·9°; the average being 61·4° during the past week, and 71·3° in 1850.

Week ending 15th May, 1851.

May.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
9	30·19	30·21	30·02	60·	68·	N.E.	N.W.	..	0·06
10	29·98	30·19	29·82	64·5	70·	E.N.E.	S.S.E.	..	..
11	30·01	30·24	29·83	64·	71·	N.N.W. to E.	E.S.E. to E.	..	..
12	30·01	30·09	29·85	60·5	71·	S.E. to S.S.E.	E.	..	..
13	29·99	30·17	29·81	58·5	71·	E. to E.S.E.	E.	0·41	..
14	30·00	30·12	29·82	60·	70·	E.	E.S.E.	0·15	..
15	30·11	30·02	29·97	64·	62·5	E.S.E.	S.W.	0·04	0·16
							Total .	0·60	0·22

Obs.—The weather of the past week has been fine, if we except two days. The wheat crops look well and are fast approaching maturity—the unbearded variety more particularly, but also some of the bearded is deficient in the size of the panicles. The average temperature of the week has been 61·6° ; that of the corresponding week in 1850, 69°.

Week ending 22nd May, 1851.

May.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
16	30·14	29·94	29·97	64·	67·5	E.S.E.	S.S.E.	..	0·46
17	30·17	29·94	29·99	68·5	76·	S.E.	O.	..	..
18	30·10	30·07	29·93	71·	74·5	S.E.	W.N.W.	..	..
19	29·97	30·07	29·78	73·5	70·5	S.S.E.	E.S.E.	..	..
20	29·87	29·89	29·83	75·	66·5	S.S.E.	E.S.E.	..	..
21	29·87	29·96	29·60	74·	69·	N.W. to N.E.	N.W.	..	0·16
22	29·98	30·14	29·81	69·	68·	N.E. to E.	W. to E.S.E.	..	0·03
							Total .	0·00	0·65

Obs.—Much has been accomplished in the fields by the peasantry during the last phase of the moon, which has been accompanied by an almost unclouded sky. At no season of the year is there greater cause to admire the Chinese husbandry than at this, the time for sowing cotton. The art with which the four-pronged implement of agriculture, half pitchfork, half hoe, is wielded, so as to act as both spade and rake, calls down our admiration. The neatness with which the beds are prepared, and the seed sown and trodden down, is one of the circumstances in which has originated the title to an almost fabulous superiority of the natives of this empire over Europeans in the cultivation of the soil. Some of the cotton sown only a few days since is already appearing above ground. The paddy intended for transplantation is now a couple of inches high. In some fields the bearded wheat is nearly ready for cutting, and the ears of the unbearded variety are improving in size. The average temperature of the past week has been 70·7° ; that of the corresponding week last year 70·3°.

Week ending 29th May, 1851.

May.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
23	29·94	30·12	29·78	71·	69·5	E.S.E. to S.E.	S. to S.E.	0·00	0·00
24	29·94	30·11	29·73	76·	75·	S.	S.E.	0·00	0·00
25	29·81	30·01	29·61	71·	81·	S.	S.E.	0·17	0·00
26	29·83	29·92	29·65	69·	84·	N.N.W.	E.S.E.	0·30	0·00
27	30·04	29·97	29·86	71·	82·5	N.N.W. to N.	N.W. to W.	0·06	0·00
28	30·17	30·07	29·98	74·5	74·5	N.N.W. to E.	N.E.	0·00	0·00
29	30·09	29·94	29·97	72·	74·5	S.E.	E.N.E. to E.S.E.	0·00	1·83
							Total .	0·53	1·83

Obs.—With the exception of Sunday the past week has been attended with continued fine weather. The bearded wheat, now arrived at maturity, has been for the most part cut down, conveyed to the farmsteads, and in some places even thrashed on the mud before the doors, with a flail, only differing from our own by having one portion to revolve upon a lateral hinge at the extremity of the half held in the hand. It is very extraordinary to observe the carelessness with which this process is conducted, and the little anxiety manifested by the peasants to keep their grain clean. The fields of stubble are being irrigated and prepared for the paddy, which will soon be ready for transplantation—some however have been devoted to cotton—and in a few the young cotton plants, which were sown among the wheat at the commencement of the month and covered with earth from the furrows, are now several inches above the surface. The average temperature of the past week has been 72·1°; that of the corresponding week in 1850, 77·3°.

Week ending 5th June, 1851.

May.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
30	29·96	30·01	29·78	73·5	80·	S.E.	W.N.W. to E.S.E.	..	1·25
31	29·91	30·08	29·62	69·	81·	S. to S.E.	S.E.	..	..
Jun. 1	29·87	30·01	29·69	66·	82·	N.W.	S.	0·05	..
2	30·06	29·98	29·90	69·	80·5	O.	E.S.E.	0·05	1·68
3	30·02	29·93	29·84	73·5	80·5	S.S.E. to N.W.	E.S.E.	0·02	1·48
4	30·04	29·91	29·86	74·5	77·	S.	E.S.E.	..	..
5	30·02	29·79	29·83	78·5	85·5	S.E.	S.E. to S.W.	0·01	0·11
							Total .	0·13	4·52

Obs.—The past week has been accompanied with uninterrupted fine weather. The fields continue to be cleared of their early crop, the thrashing and winnowing of which is proceeding vigorously. A great change has taken place in the appearance of the country, arising from the removal of the wheat crop, and the transplanting of the paddy, which is now progressing rapidly. The method of performing this agricultural operation is well worth the attention of those interested in such processes. The neatness and rapidity with which it is accomplished is truly surprising. The average temperature of the past week has been only 72°, while that of the corresponding week in 1850 attained to 80·9°—showing in a marked manner the comparatively low temperature which has accompanied the whole of this spring.

Week ending 12th June, 1851.

June.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
6	30·07	29·89	29·89	72·	75·5	S.E.	N.W.	..	0·42
7	30·05	30·10	29·86	65·	73·5	E.	N.W.	0·45	..
8	29·73	30·11	29·56	70·	78·	N.W.	N.W. to N.N.E.	2·41	..
9	29·89	30·13	29·75	74·	79·5	N.N.W.	S.S.E.	..	..
10	29·89	30·14	29·70	74·5	75·5	E.	S.E. to E.S.E.	..	..
11	29·93	30·03	29·74	69·	75·	E.S.E.	S.E. to N.E.	0·06	..
12	29·94	29·88	29·75	65·	74·	E.	N.W.	0·06	..
							Total .	2·98	0·42

Obs.—The weather of the past week has been unusually cold for this season of the year; the average temperature only attaining 69·9°, while in the corresponding week of 1850 the average height of the mercurial column was 75·8°; much rain, accompanied by strong gusts of wind, occurred during the night of the 7th.

Week ending 19th June, 1851.

June.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
13	29·92	29·87	29·73	66·5	76·5	N.E.	N.W. to E.	0·06	..
14	29·91	29·86	29·72	70·	75·	E.N.E. to N.E.	S.E.	..	..
15	29·91	29·86	29·71	75·	82·	E.	S.E. to E.S.E.	..	..
16	29·91	29·85	29·71	77·	73·5	S.E.	E. by S. to E.	..	0·02
17	29·85	29·90	29·63	81·5	74·5	S.	S.E.	..	0·03
18	29·67	29·88	29·50	83·	73·5	S.S.E.	S.E.	..	..
19	29·76	29·85	29·58	72·	68·5	N.E. to N.N.E.	E.S.E. to E.	0·80	0·18
						To 9 o'clock	this morning	2·95	..
							Total .	3·81	0·23

Obs.—The weather of the last week has been fine and well adapted to the final duties of the wheat harvest. The fields now present the transplanted paddy or the cotton plant rendered visible by the removal of the wheat. The temperature has been gradually increasing—the evening of the 18th being exceedingly oppressive—until the air was cooled by a heavy fall of rain, which has continued to descend, with little intermission, up to the present time. The average temperature of the week has been 75·3°; that of the corresponding week last year 74·8°.

Week ending 26th June, 1851.

June.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
20	29·78	29·68	29·60	68·	73·	N.E. to E. by S.	W.	2·95	0·06
21	29·84	29·78	29·63	79·5	75·	O.	N.W.	0·05	0·04
22	29·86	29·91	29·67	74·	85·	S.E.	S.E.	..	..
23	29·90	29·90	29·68	76·	78·5	S.E.	N.E.	..	..
24	29·95	29·79	29·73	78·5	76·5	S.E.	N.W.	..	2·18
25	30·01	29·76	29·80	79·	72·	S.E. to S.S.E.	O.	..	0·58
26	29·97	29·88	29·78	73·	67·	S.	N.W.	0·40	2·33
							Total .	3·40	5·19

Obs.—The past week, which has been accompanied with much rain, has been spent by the peasants principally in clearing the young cotton plants of the surrounding weeds and in hoeing up the ground about their

roots. The temperature has been very nearly equal to that of last year, having only exceeded last year's average by 0·1°; the present week's average being 75·4°.

Week ending 3rd July, 1851.

June.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
27	29·89	29·86	29·67	80·5	65·	S.E. to N.E.	E.	0·20	0·21
28	29·84	29·81	29·57	79·	68·	S. to S.E.	N.E. to E.	0·70	0·40
29	29·85	29·95	29·64	73·	70·5	N.W.	E.S.E.	0·20	0·07
30	29·86	29·81	29·66	78·5	71·	E.S.E.	S.E. to E.S.E.	1·80	..
July 1	29·70	29·76	29·50	87·	69·	S.	E.N.E.	..	0·46
2	29·84	29·82	29·62	84·5	69·5	W.	E.	0·72	0·20
3	29·83	29·87	29·63	83·5	71·5	S.E.	E. to E.S.E.	0·10	0·24
							Total .	3·72	1·58

Obs.—For the first time during the present season has the temperature exceeded the average of that of the corresponding week of the previous one. This week's average height of the thermometrical column has been as much as 80·8°—and were this day's observations included this average would have been higher, as the mean temperature to-day has been 86·5°. Last year's corresponding week was uncommonly cold, the thermometer only attaining an average of 69·2°—lower by 11·6° than in 1851. The sky has been more or less clouded during the entire week, and much rain has fallen. The crops, however, are looking very promising.

Week ending 10th July, 1851.

July.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
4	29·74	29·91	29·51	86·5	74·	S.E. to S.W.	E.S.E.	..	..
5	29·67	29·92	29·47	76·5	72·5	N.E.	E.S.E. to S.E.	0·10	..
6	29·80	29·86	29·61	73·	79·5	N.E. to E.N.E.	S.	0·30	0·14
7	29·71	29·84	29·52	69·	83·	E. to N.E.	S. to W.	1·85	..
8	29·87	29·80	29·77	72·5	81·	N.W.	O.	0·35	0·19
9	30·08	29·79	29·90	72·	78·	N.E. to E.S.E.	N.E. to E.S.E.	0·05	0·12
10	30·07	29·83	29·88	81·	76·5	S.E.	N.W.	..	0·31
							Total .	1·65	0·76

Obs.—After the excessive heat of the 4th the temperature suddenly sunk 19°, and continued uncommonly low up to yesterday. The sky was overcast during the entire period, and a considerable fall of rain took place. During this time the peasants have had abundant occupation in hoeing and weeding the cotton and rice crops, which have grown with a rapidity totally incomprehensible to agriculturists in a more temperate climate. The average height of the thermometer during the week has been 75·7° to 77·7° in 1850.

Week ending 17th July, 1851.

July.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
11	80·00	29·85	29·82	85·5	77·	S.E.	S.W.	..	0·66
12	29·92	29·85	29·72	87·	78·5	S.E.	S.E. to N.W.	..	1·54
13	29 89	30·00	29·08	86·5	76·	S. to S.S.E.	E. to S.E.	..	0·03
14	29·89	30·02	29·68	87·	84·5	S.S.E. to S.	S. by E.	..	..
15	29·94	30·03	29·72	91·	86·	S.S.E.	S.W. to S.E.	..	..
16	29·98	29·94	29·76	91·5	87·5	S.S.E. to S.	S.W.	..	.
17	29·93	29·87	29·75	91·5	89·	S.S.E.	S.W.	..	..
							Total .	..	2·23

Obs.—The weather of the past week has been hot, dry, and scorching. The average temperature has been 88·5°, or 5·9° over the average of the corresponding week last year. The ground has become cracked and parched, and the crops have required irrigation. The fields have presented quite a lively appearance in the morning and evening, contrasted with the perfect silence of noon-day, when no living creature ventures forth.

Week ending 24th July, 1851.

July.	Barometer.		Aneroid.	Thermom.		Wind.		Rain.	
	1851	1850	1851	1851	1850	1851	1850	1851	1850
18	29·89	29·86	29·68	93·	88·	S.S.E.	S.S.E. to S.	..	..
19	29·87	29·83	29·69	93·5	86·	S.E. to S.S.E.	S.S.E.	..	..
20	29·83	29·89	29·63	91·5	87·	S.E. to S.S.E.	S.E. to E.S.E.	..	..
21	29·79	29·81	29·56	93·	87·5	S.S.E.	E. to N.E. by N.	..	..
22	29·84	29·83	29·62	91·	90·5	S.S.E.	S.W.	1·50	..
23	29·86	29·96	29·63	92·5	90·	S.E. to S.S.W.	S.	..	..
24	29·86	29·97	29·63	92·	89·5	S.E.	S. to S.S.E.	..	..
							Total .	1·50	..

Obs.—The weather of the past week has been exceedingly hot—the average temperature being 92·0°, or 3·7° above that of the corresponding week last year. The evenings, however, have been somewhat cooled by the occurrence of thunderstorms, more particularly on the 21st, when the squall was really very heavy. The crops continue to look well.

VI.—*On the Climate and Vegetation of the Temperate and Cold Regions of East Nepal and the Sikkim Himalaya Mountains.* By J. D. Hooker, M.D., F.R.S.

The following notes were collected, and have here been thrown together, with the view of facilitating the cultivation of Himalayan plants, and of those of Sikkim and the adjacent mountains of Nepal in particular, by supplying accurate data obtained on the spot, relative to the various conditions of soil and exposure, the degrees of temperature and amount of humidity under which they flourish in their native country.

As the genus Rhododendron is the most prominent of these plants, and that about which inquiries are constantly directed to me, I shall commence with a description of it, prefacing this with some observations, which are called forth by a visit to several nurseries where many species are cultivated with more or less success.

The Sikkim species of Rhododendron have now all been described, as far as they are known, and with few exceptions figured, in a manner that will ensure the recognition of our seedlings when they blossom; but it must not be expected that the flowers, so impatiently looked for, will in all or perhaps in most cases equal, in number and size, those of the drawings made on the spot, which were in many instances from the choicest bouquets that could be procured over a large extent of country.

Unexampled success has attended cultivators in the germination of the seeds. Seedlings have been raised in quantities; but whereas in some cases the young plants have, with few exceptions, been all reared, in others the whole crop has been lost through injudicious treatment. The different kinds are at present kept together and treated alike; there is no discrimination exercised in their culture; the same amount of light and heat as is given to the natives of 6000 and 7000 feet elevation, which are in full leaf throughout the year, is also given to those from 15,000 feet, whose vegetative organs are in activity for only five or six months of the twelve. This course will eventually prove prejudicial, for it is not possible that the alpine kinds can long endure the excitement of perennial heat and moisture.

Variation.—There is a prevailing disposition to limit the species of this genus by characters presented in the seedling plants, and to argue, from my inability to pronounce arbitrarily on the same in our greenhouses, the probability of there being fewer or more species than of names received with the seeds. In some cases an undue value is given to these names. Slight varia-

tions in the strength of the stem, colour, texture, and hairiness of the leaf, are regarded as certainly indicating specific differences; whilst other kinds are considered as the same, because undistinguishable in their present infant condition. Some of the latter certainly resemble one another in foliage, even when full grown, but are nevertheless totally distinct in flower and in fruit. I may instance R. *cinnabarinum*, R. *camelliæflorum*, and R. *Maddeni*, as one case in point; R. *campylocarpum* and R. *Thomsoni* as another; R. *campanulatum* and R. *fulgens* as a third instance of species being often so alike in the leaf, as generally to puzzle me when I had nothing else to judge by; and yet there is in the two former cases little affinity between them. My attention was drawn to this point throughout a residence of many consecutive months (including the flowering and fruiting seasons of the Rhododendron) at elevations varying from 8000 to 16,000 feet. It is especially between 10,000 and 14,000 feet that the genus prevails; several species comprising three-quarters of the bulk of the vegetation above the forest-region (12,000 feet). There Rhododendron wood supplies the native with fuel, and, from its tough nature and property of being easily worked, with many domestic utensils, poles for his tent, stools, saddle, bowl and spoon; the bark is used as that of the birch is in arctic regions, and the leaves serve as plates and wrappers for butter, curd, and cheese. It is the traveller's constant companion throughout every day's march; on the right hand and on the left of the devious paths, the old trees and bushes are seen breast high or branching over head, whilst the seedlings cover every mossy bank. At 13,000 feet the flanks of the snowy mountains glow with the blood-red blossoms of R. *fulgens*, whilst the beauty of R. *campanulatum* and the great elegance and delicacy of the white bells of R. *campylocarpum* excite the more admiration from their being found in such regions of fog and rain. Yet with all these advantages of position, and that of an intimate knowledge of the species, I was constantly at a loss to distinguish to which species the seedling plants belonged, especially when they grew intermixed, or to recognize others when distant from their parents.

Not only does the very variable nature of the foliage render it exceedingly difficult to recognize even the best known kinds by these organs, but the species themselves run into races, stirpes, or constant varieties, assuming under certain circumstances characters inherited by the seedlings. This is habitually the case with those that have considerable ranges in elevation; they alter their habit materially (as willows do in our own country), and there is more apparent difference between the robust, hardy, rusty-leaved, dark-coloured seedlings from an

alpine locality, and the young plants of the same species from wooded regions lower down, than between some widely distinct species. I have hereby been led into much error in my illustrated work on Sikkim Rhododendrons, which I shall endeavour to remedy in the present essay.

Hybridization in a Native State.—It has been insisted that many of the so-called species of this genus are naturally-produced hybrids. This is by no means clear to me, though I am far from denying its possibility, and I am aware of the many obvious facilities for such a process: it shares the plausibility of all hypotheses against which negative proof only can be brought to bear. A gardener's opinion is in such cases of value, as he can best appreciate the power of an agent he employs himself with great effect, and to which the attention of botanists is being drawn through the pages of this Journal especially. Considering, however, the consequences which have attended the process of hybridizing Rhododendrons in our gardens, it appears to me that were such an operation actively pursued by nature, or tardily throughout a series of years, in the Rhododendron region of the Himalaya, the species would be in the condition of *Salix*, *Rubus*, *Rosa*, *Mentha*, and many other familiar examples of hopelessly entangled assemblages of species. Where the Rhododendron "scrub" prevails, it is impossible for any but very strong growing plants to establish a footing; a mule would have little chance of a flourishing existence and numerous offspring in so dense a mass; but the prevalence of land and snow-slips often lays bare broad tracts of land, which are for years but scantily clothed with vegetation. From the constant local changes of surface that hence ensue, there is no want of opportunity and space for hybrids to establish themselves. Believing it probable that this genus has survived slow but great changes in the physical geography and climate of the country, especially with relation to the snow-level, I cannot but conclude that varieties, perhaps permanent ones, may have been induced, which are now regarded as species; and this has prompted me to unite some plants from very different elevations which, though varying much, present no well-marked specific characters. Such are R. *elæagnoides*, R. *salignum*, and R. *obovatum*. All these I include under Wallich's R. *lepidotum*, to which a range in elevation of upwards of 7000 feet is consequently given, but I cannot trace the influence of hybridization in itself or any allied species. It is accompanied by twenty congeners in its ascent from 7000 to 15,000 feet, but except that its flowers vary from yellow to a dirty purple, at various heights, neither it nor they present any characters that can be attributed to hybridization. R. *fulgens* is the most suspicious-looking plant in this respect,

having the leaves of R. *campanulatum*, and capitula and flowers of a scarlet variety of R. *arboreum;* but considering how variable R. *campanulatum* is in colour, and that it assumes a denser capitulum in its variety *æruginosum* (which I published as a species), I should be more inclined to rank R. *fulgens* as a permanent variety of that species than as a mule between it and a plant with a totally dissimilar leaf, which is comparatively tender, and which grows 4000 feet lower down. The principle of hybridization is a dangerous one to admit heedlessly in these cases, and should only be resorted to as a forlorn hope, when every other attempt to account for the Protean habits of an assemblage of species has failed: such I cannot consider to be the case with the Sikkim Rhododendrons; and though I do not abandon the idea in theory, I shall not adopt it in this emergency.

Epiphytical Habits of some Species.—Much undue importance has been given to the fact of some kinds growing habitually epiphytically (R. *Dalhousiæ*, R. *camelliæflorum*, R. *pendulum*), and it has been supposed that much difficulty must attend their cultivation. Having occasionally seen all these species growing on rocks, and the two latter sometimes becoming erect, and that always in exposed but very moist localities, I have been induced to attribute their predilection for the branches of trees to their weak habit and want of light elsewhere. Being plants of the forest region, and unable to contend against the vigorous undergrowth that prevails there, the offspring of such seeds as fall on the ground are choked, whilst the perennially humid atmosphere supports such as sprout on the mossy limbs of trees, where they receive the stimulus of light. R. *Dalhousiæ*, for instance, which is never found on the ground in the woods of Darjiling, grows in thousands on the clay and mould banks of the roads which are cut through the forest, the young plants coming up in profusion as soon as the cuttings are made: these, however, seldom attain any size, from the too great exposure of the soil, which in the dry season rapidly parches during a short day's heat. In Dr. Campbell's garden at Darjiling there is a perpendicular bank, 15 feet high, exposed to the west, and partly sheltered from the south-west by a house. R. *Dalhousiæ* has annually appeared on this, the seeds being imported by winds or birds from the neighbouring forest. The seedlings, however, perished till within the last two years, since which time abundance of *Lycopodium clavatum* and a *Selaginella*, with *Marchantia*, retain so constant a supply of moisture that the plants now flourish and flower in perfection. Though not equal to the herbaceous, the number of small shrubby forest plants that grow on the trees in these damp regions is very great, especially the orchideous. Those that do so most habitually are species of *Vaccinium*

(*serpens* and others). These are all provided with soft woody swellings on the root, of all sizes, from that of a nut to the thickness of a man's thigh, which, though structurally the same as other parts of the root, serve as reservoirs for a great quantity of fluid destined to nourish the plant in the drier season of the year. These plants never grow on the ground, properly speaking, but often on exposed rocks, where the use of these tubers is more evident, and it is a part of their economy to be so provided. The Rhododendrons have never such organs, and there is no difference between the root of a specimen grown on the ground and one from a mossy tree-trunk. Such species as are habitually epiphytical require a lighter soil, with plenty of moss, and a very damp, humid, equable temperature; and will, I am sure, present no insuperable obstacles to the cultivator.

Soil.—There is in this respect little variety throughout Sikkim, and, as far as vegetation is concerned, it may be divided into vegetable mould and stiff clay—each, as they usually occur, remarkably characteristic in composition of such soils.

The clay is uniformly of great tenacity, and is, I believe, wholly due to the effect of the atmosphere on crumbling gneiss and other rocks. It is tenacious, seldom friable, and sometimes accumulated in beds 14 feet thick, although more generally of only about 2 feet. In certain localities, beds or narrow seams of purer felspathic clay on vegetable matter occur in it, probably wholly due to local causes. An analysis of that near Darjiling gives about 30 per cent. of alumina, the rest silica, and a fraction of oxide of iron. Lime is wholly unknown as a constituent of the soil, and only occasionally seen as a stalactitic deposit from a few springs.

The vegetation has always good drainage, from the broken nature of the subjacent highly-inclined stratified rocks: with the Rhododendrons of the second zone this is especially the case, and they thrive luxuriantly on the soil overlying old moraines.

A layer of vegetable earth almost invariably covers the clay for the depth of 3 to 12 or 14 inches. It is a very rich black mould, held in its position on the slopes of the hills by the dense vegetation, and accumulated by the banks of small streams to a depth at times of 3 and 4 feet. R. *arboreum* is one of the few species that seem to avoid this soil, but, I think, in appearance only—that species loving exposure, and therefore occupying a comparatively poor dry soil, over which other things do not extend. I have seen R. *arboreum* and *barbatum* growing on the margins of pools of water, in what is almost bog earth; but pools and bogs are rare in Sikkim, and of very local occurrence. The following is an analysis of an average specimen of

the surface-soil of Darjiling, made for me by my friend C. J. Müller, Esq., of that place:—

A.—Dry Earth.

Anhydrous	83·84
Water	16·16
	100·0

B.—Anhydrous Earth.

Humic acid	3·89
Humine	4·61
Undecomposed vegetable matter	20·98
Peroxide of iron and manganese	7·05
Alumina	8·95
Silicious matter, insoluble in dilute hydrochloric acid	54·52
Traces of soda and muriatic acid	..
	100·0

C.—Soluble in water, gr. 1·26, consisting of soda, muriatic acid, organic matter, and silica.

The soil from which this example was taken was 12 inches deep; it abounded to the eye in vegetable matter, and was silicious to the touch. There were no traces of phosphates or of animal matter, and doubtful traces of lime and potash. The subsoil of clay gave only 5·7 per cent. of water, and 5·55 of organic matter. The above analysis was conducted during the rainy month of September, and the sample is an average one of the surface-soil at 6000 to 10,000 feet. There is, I think, little difference anywhere in the soils at this elevation, except where the rock is remarkably micaceous, or where veins of felspathic granite, by their decomposition, give rise to small beds of kaolin.

At elevations above 10,000 feet, the rocks are generally much harder, the gneisses and schists are baked by metamorphic action, and more granitic rocks prevailing, a lighter and more sandy soil is met with. Towards the southern parts of Sikkim, the copious rains wash away at once the scanty annual deposit of humus at these great elevations: there is consequently no sward or peat; the plants, shrubby and herbaceous, growing out of a generally naked soil in tufts. In the northern parts, again, there is a considerable accumulation; and at equal and greater elevations a sward of *Cyperaceæ* and *Gramineæ* are found, nourishing a tolerably rich Flora. Further north still, in the Tibetan climates, at 15,000 to 17,000 feet, the climate is too dry for anything but an arid Flora, except along the borders of streams.

Generally speaking, I conclude that a rich light vegetable

mould of loam and peat, with good drainage, are necessary for the shrubby plants of these regions.

On the Species.—Since the preparation of the several parts of the illustrated work on the Sikkim Rhododendrons, my opinions, which were then far from fixed as to the limits of some of the species, have changed, with the many additions to the localities, &c., I have collected. When the first part was published, I had only seen single specimens of some of the species figured; and without books of reference of any kind, I was unable to determine their names; the specimens and drawings sent differed so widely from cultivated individuals, and from the indifferent herbarium specimens attainable, that they were pronounced new, and published accordingly. The results of a careful study of all my species and specimens are, that of those figured in the first part, R. *Campbelliæ* does not differ from R. *arboreum*, R. *lancifolium* from R. *barbatum*, R. *Wallichii* from R. *campanulatum*, and R. *Roylei* from R. *cinnabarinum*.

In the second part a synoptical view of all the Indian species is given, in which some of these errors are indicated, and the species are thrown into groups defined by characters I still think natural and constant. In this and in the concluding (third) part 22 more Rhododendrons are figured as species, several of which were regarded by myself as well-marked forms or varieties only, and as such worth figuring, but which were published with the provisional specific names I attached to them. To these I shall allude hereafter. Lastly, I have gone over the Bhotan collections of Mr. Griffith, and identified all his 14 species with my own, except the one figured by Dr. Wight as R. *grande*. Of this I find no specimen in the set of Griffith's plants given to Sir W. Hooker, except it be the R. *Hodgsoni*, which I can hardly reconcile with the plate and description in Dr. Wight's Icones. Dr. Wight's R. *Griffithii*, on the other hand, I find to be founded on a very starved state of R. *Aucklandii*, a name which I waive.

Bhotan borders upon Sikkim to the eastward, and presents the same characters of humidity in that western part (whence Mr. Griffith's specimens were procured) as Sikkim does. Its lower and outer ranges of hills, however, being drier (from reasons hereafter to be explained), it does not appear to be so rich in Rhododendrons, and hence probably no peculiar species are found; for to the eastward of Bhotan again, in the "Durrung" country, other species have been discovered by Mr. Booth.

I shall now give a list of the 27 Sikkim species known to me, arranged in natural groups, with such brief characters as are necessary for determining them when they shall flower. An account of the geographical features of Sikkim will follow, and a division

of the country into zones, each inhabited by a different vegetation of Rhododendrons and other plants. Some more general description of the species, with remarks on their appearance, habits, and relations to soil, climate, &c., will naturally be brought in there; and I shall conclude with a rather minute account of the climate, temperature, &c., of the three zones of the Himalaya, which may be termed Temperate, Alpine, and Arctic, and which are best defined by the limits attained by *Coniferæ* and *Rhododendrons*.

Synopsis of Species.

§ I. *Calyx* 0. *Corolla* broadly bell-shaped, 10-lobed. *Stamens* 18 to 20 (rarely 10). *Ovary* usually hairy or viscid, or both, many celled.—Trees with large leaves, and white or pale coloured densely clustered flowers.

1. R. *Falconeri*—a tree; leaves very large and coriaceous, obovate or oblong, blunt, on very stout leaf-stalks, smooth, shining above, with sunk netted veins, below covered with thick rusty down; flower-stalks viscid; flowers white, in dense heads; stamens 16; style thick, with a club-shaped broad stigma.—*Sikkim Rhod.*, Pl. X.

2. R. *argenteum*—a tree; leaves very large, obovate, oblong, sharp, narrowed into the thick leaf-stalk, quite smooth on both sides, silvery below; heads rather loose, 10-flowered; flower-stalks short, downy; flowers white, broadly bell-shaped; stamens 10; ovary downy, about 16-celled.—*Sikkim Rhod.*, Pl. IX.

3. R. *Hodgsoni*—a large bush; leaves broad, elliptical, obovate or oblong, on stout leaf-stalks, sometimes heart-shaped at the base, smooth and shining above, somewhat silvery below, with closely appressed down; heads 15 to 30 flowered; flower-stalks short, downy; flowers broadly bell-shaped, 8 to 10 lobed, pale purple; stamens 16 to 18; ovary downy, 16-celled.—*Sikkim Rhod.*, Pl. XV.

§ II. *Calyx* cup-shaped, more or less broad and deep, very obscurely lobed. *Corolla* 5-lobed. *Stamens* 10 to 16. *Ovary* 6 to 16 celled.—Shrubs with large flowers, and quite smooth leaves.

4. R. *Griffithii*, Wight (R. *Aucklandii*, *Sikkim Rhod.*, Pl. XI.)—leaves on rather long foot-stalks, oval, oblong, sharp, somewhat cordate at the base, quite smooth on both sides; flowers few, on long foot-stalks; calyx a broad open disc, unequally 5-lobed; corolla white, with a broad tube, and 5 very

broad spreading lobes; stamens 12 to 18; ovary glandular, 12-celled.

5. R. *Thomsoni*—a bush; leaves at the end of the branches, orbicular or broadly oblong, rounded at the end or terminating in a short point, on rather long leaf-stalks, heart-shaped at the base, quite smooth on both sides, rather glaucous below; head 4 to 6 flowered; flowers deep crimson, drooping, on long foot-stalks; calyx cup-shaped, sometimes tubular, unequally lobed; tube of the corolla rather long, bell-shaped, lobes recurved, notched; stamens 10; ovary quite smooth, 6 to 10-celled.—*Sikkim Rhod.*, Pl. XII.; and R. *candelabrum*, Pl. XXIX.

§ III. *Calyx* of 5 leaves, or deeply 5-lobed. *Corolla* funnel or bell shaped. *Stamens* 10 to 18. *Ovary* 5 to 6 celled.—Trees or shrubs; sometimes epiphytes, with the leaves often covered with small scales.

6. R. *Dalhousiæ*—a slender shrub; young leaves with long hairs, the older ones elliptico-obovate, blunt, smooth above, rather glaucous below, and dotted with very small scales, narrowed at the base into a leaf-stalk which is sometimes a little hairy; flowers 3 to 5 in a head, nodding; sepals oblong, blunt, hairy on the margin; corolla bell-shaped, with a broad tube and 5 moderately spreading lobes; stamens 10; ovary 5-celled.—*Sikkim Rhod.*, Pl. I. and II.

7. R. *Edgeworthii*—a straggling shrub, generally growing on the branches of trees; branchlets leaf and flower-stalks densely covered with a thick tawny down; leaves elliptical ovate, very sharp, bright green and shining above, reticulated with sunk veins; flowers 2 to 3 together, large, white; flower-stalks short; sepals woolly, blunt; tube of the corolla rather short, lobes large and spreading; stamens 10; ovary very woolly, about 5-celled.—*Sikkim Rhod.*, Pl. XXI.

8. R. *barbatum*, Wall.—a small tree; leaves elliptical, lanceolate, sharp, blunt at the base, with stout leaf-stalks which have generally long bristles; quite smooth on both sides, paler below; flowers in dense heads, pale blood-red; flower-stalks short; sepals oblong, blunt, viscid; stamens 10; ovary viscid and hairy, 5 to 8-celled.—*Sikkim Rhod.*, Pl. III.; and R. *lancifolium*, Pl. IV.

9. R. *ciliatum*—a low rigid shrub; branches leaf and flower-stalks covered with stiff spreading hairs; leaves on short foot-stalks, elliptical, obovate, very sharp, bright green above, the margins and mid-rib with stiff spreading hairs, paler and rather glaucous below, dotted with small scales; flowers 4 or 5 to-

gether, pale purple, on stout short flower-stalks; sepals broadly ovate, blunt, ciliated at the margin; corolla bell-shaped, with spreading recurved lobes; stamens 10; ovary scaly, 5-celled.—*Sikkim Rhod.*, Pl. XXIV.

10. R. *glaucum*—a small slender shrub; branchlets leaf and flower-stalks and the leaves generally on both sides, calyx and ovary dotted with small scales; leaves obovate, lanceolate, pointed, narrowed into a slender leaf-stalk, bright green above, very glaucous below; flowers 6 or 8 in a head, pale pink purple; sepals oblong, sharp; corolla bell-shaped, dotted with small glands, and hairy inside at the base; stamens 10; ovary 5-celled.—*Sikkim Rhod.*, Pl. XVII.

11. R. *pumilum*—a very small, slender, sparingly-branched Alpine shrub, with creeping stem and erect branches, which, as well as the flower and leaf stalks, under side of the leaves, calyx and ovary, are dotted with small brown scales; leaves small, on very short foot-stalks, broadly elliptical, blunt with a short point, margin recurved, dark green above, glaucous below; flowers nodding, solitary, or 2 to 3 on long erect stalks; sepals blunt; corolla bell-shaped, rosy, tube hairy, lobes short, rather spreading; stamens 10; ovary 5-celled.—*Sikkim Rhod.*, Pl. XIV.

§ IV. *Calyx* small or none. *Corolla* bell or funnel shaped. *Stamens* 10. *Ovary* 5 to 10 celled.—Shrubs or small trees, generally smooth.

12. R. *arboreum*—a tree; leaves very coriaceous, lanceolate, acute, cordate at the base, or narrowed into a stout petiole, bright green above, reticulated with sunk veins below, smooth and silvery, or covered with a rusty down; flowers in dense heads; calyx none; corolla bell-shaped, white, pink, or blood-red; stamens about 10; ovary 7 to 10 celled.—*Sikkim Rhod.*, R. *Campbelliæ*, Pl. VI.

13. R. *niveum*—a small tree; branchlets and underside of leaves leaf and flower-stalks thickly covered with white wool; leaves obovate, lanceolate, blunt or sharp, on short foot-stalks, quite smooth above, opaque; flower-stalks short; capsules short, downy, 6-celled.

14. R. *campanulatum*—a densely branched shrub; branchlets leaf and flower-stalks and underside of leaves more or less covered with a thick down; leaves obovate, sharp or blunt, cordate at the base, on stout leaf-stalks, smooth and bright green above, sometimes also almost smooth below; flowers 8 to 10 in loose heads, rose or lilac, sometimes spotted; flower-stalks rather long; calyx with 5 short blunt teeth; corolla bell-shaped, with

recurved lobes; stamens 10; ovary quite smooth, 5 to 8 celled. —R. *Wallichii; Sikkim Rhod.*, Pl. V.; and R. *æruginosum*, Pl. XXII.

15. R. *fulgens*—a small bush, differing only from R. campanulatum in its dense heads of blood-red flowers, which resemble those of R. arboreum; and in the capsule, which is broader and of a fine purple colour.—*Sikkim Rhod.*, Pl. XXV.

16. R. *lanatum*—a small tree; branchlets flower and leaf-stalks underside of leaves and ovary densely covered with a whitish wool; leaves obovate, blunt with a short point, narrowed into a short foot-stalk; flowers 6 to 8 in a loose head, nodding; flower-stalks rather long; calyx of 5 small blunt teeth; corolla broadly bell-shaped, pale straw colour, with purple spots inside; stamens 10; ovary 5-celled.—*Sikkim Rhod.*, Pl. XVI.

17. R. *Wightii*—a large branching shrub; leaves elliptical, lanceolate, sharp, narrowed below into a stout downy leaf-stalk, smooth and bright green above, covered beneath with a closely pressed reddish down; heads large, rather loose, and many flowered, on downy foot-stalks; calyx of 5 very small teeth; corolla broadly bell-shaped, 5-lobed at the base, straw-coloured, spotted above with red; stamens 10; ovary glandular and downy, 10-celled.—*Sikkim Rhod.*, Pl. XXVII.

18. R. *campylocarpum*—a shrub, with slender branches; leaves ovate or oblong, blunt with a short point, heart-shaped at the base, smooth and shining above, paler and rather glaucous below; leaf-stalks slender, as are the flower-stalks, which, as well as the calyx and ovary, are more or less covered with glandular hairs; flowers nodding, 5 to 10 in loose heads; calyx of 5 small rounded lobes; corolla broadly bell-shaped, with spreading lobes, pure white or pale straw colour; stamens 10; ovary 5-celled.—*Sikkim Rhod.*, Pl. XXX.

§ V. *Calyx* of 5 short lobes or teeth, the upper sometimes elongated. *Corolla* funnel-shaped, tube narrow. *Stamens* 10 to 20. *Ovary* 5 to 10-celled.—Shrubs with the leaves scaly on the underside.

19. R. *Maddeni*—an erect twiggy shrub; branchlets leaf and flower stalks underside of leaves calyx and ovary thickly studded with small scales, which are also scattered over the tube of the corolla; leaves elliptic, lanceolate, sharp at both ends, bright green and shining above, tawny below; flowers nodding, white, very large, 2 or 3 together, on short stalks; tube of the

corolla elongated, with 5 spreading lobes; stamens 18 to 20; ovary 10-celled.—*Sikkim Rhod.*, Pl. XVIII.

20. R. *cinnabarinum*—a shrub with slender branches; underside of leaves leaf and flower stalks calyx and ovary studded with small scales; leaves ovate or oblong, lanceolate, sharp at both ends, rather opaque, green above, tawny or rusty coloured below; flowers rather small, nodding, 4 to 8 together, in loose heads; calyx lobes very variable in size; corolla brick-red, tube long, lobes rounded, spreading, rather sharp; stamens 10; ovary 5-celled.—*Sikkim Rhod.*, Pl. VIII.; and *R. Roylei*, Pl. VII. (neither very characteristic figures).

§ VI. *Calyx* of 5 lobes. *Corolla* with the tube very short and swollen, the lobes spreading, concave. *Stamens* 8 to 10. *Style* short and curved. *Ovary* 5-celled.—Generally small shrubs, sometimes epiphytes. Leaves (except in R. pendulum) densely scaly.

21. R. *camelliæflorum*—a slender shrub, generally pendulous from the branches of trees; branchlets flower and leaf stalks under surface of the leaves calyx and ovary densely dotted with small scales; leaves elliptical, lanceolate, sharp at the end, generally blunt at the base, bright green above, brownish beneath, on short stout foot-stalks; flowers solitary or 2 together, on short curved stalks; sepals thick and blunt; corolla white, of a firm thick texture, dotted with scales; stamens 16; filaments short and thick; ovary 10-celled.—*Sikkim Rhod.*, Pl. XXVIII.

22. R. *pendulum*—a very slender shrub, generally hanging from the branches of trees; branchlets leaf and flower stalks calyx and ovary densely covered with a rusty-brown wool, under which are scattered scales; leaves elliptical, blunt with a short point, on very short leaf-stalks, bright green and shining above; flowers 2 together, small, white; sepals membranous, oblong, blunt; corolla sparingly scaly outside; tube short; lobes large, spreading; stamens 10; filaments woolly; ovary 5-celled.—*Sikkim Rhod.*, Pl. XIII.

23. R. *lepidotum*, Wall.—A small branching bush; the branchlets leaf and flower stalks leaves generally on both sides calyx and corolla externally more or less dotted with white or rusty brown scales; leaves obovate, lanceolate, or oblong, on short petioles, of a pale or lurid green colour; flowers terminal, solitary, or 2 to 3 together on slender erect stalks; sepals 5, blunt; corolla pale or deep yellow, or purple; tube short, globose; lobes spreading, concave, the upper more or less spotted; stamens

8; ovary 5-celled.—*R. salignum; Sikkim Rhod.*, Pl. XXIII. A.; *R. elæagnoides*, Pl. XXIII.; *R. obovatum*, part 2, page 6.

24. R. *vaccinioides*—a small, very slender, sparingly branched shrub, sometimes epiphytical, with the branches scarred; branchlets leaf and flower stalks and underside of leaves sparingly scaly; leaves coriaceous, obovate, blunt or notched, narrowed into a short stalk, quite smooth and bright green above, paler below; flowers solitary, terminal, on slender stalks; sepals ovate, blunt; tube of the corolla short, hairy inside, white; lobes spreading, rounded; stamens 10, exserted; filaments hairy; ovary 5-celled.—*Sikkim Rhod.*, part 2, page 3.

§ VII. *Calyx* of 5 short lobes. *Corolla* with the tube short, funnel-shaped, lobes long, narrow, spreading. *Stamens* 8. *Style* slender. *Ovary* 5-celled.—Small scaly shrubs, with Azalea-like flowers.

25. R. *virgatum*—a slender erect shrub; branchlets leaf and flower stalks underside of leaves calyx and ovary densely studded with scales; leaves linear, oblong or ovate, sharp or blunt with a short point, rounded or cordate at the base, on short foot-stalks, bright green and shining above, glaucous and sometimes rusty below; flowers 2 to 3 together, nodding on rather long stalks, yellow or pale purple; calyx lobes rounded, ciliated; corolla variable in size, tube short, conical, lobes 5, oblong, blunt; stamens 8 to 10; ovary 5-celled.—*Sikkim Rhod.*, Pl. XXVI., A.; and *R. triflorum*, Pl. XIX.

26. R. *setosum*, Don—a very small shrub; branchlets leaf-stalks and margins of the leaves bristly; these parts, as well as the flower-stalks both sides of the leaves calyx and ovary densely scaly; leaves on short foot-stalks, small, oblong or obovate, deep green above, rather glaucous below; flowers red-purple, 2 to 4 together, terminal on rather short stalks; sepals 5, oblong, blunt; tube of the corolla very short, lobes linear, oblong, spreading; stamens 8 to 10, exserted; ovary 5-celled.—*Sikkim Rhod.*, Pl. XX.

27. R. *nivale*—a small, depressed, prostrate, spreading shrub, with very woody stem and branches, everywhere studded (except the corolla) with scales; leaves crowded, very small, elliptical, blunt, almost sessile, lurid green; flowers terminal, solitary, on very short stalks; sepals 5, oblong, blunt; corolla pink purple, tube very short, hairy inside, lobes oblong, blunt; stamens 8 to 10; anthers large; ovary 5-celled.—*Sikkim Rhod.*, Pl. XXVI., B.

§ VIII. *Calyx* of 5 membranous sepals. *Corolla* salver-shaped, tube slender, short, cylindrical, lobes flat, spreading. *Stamens* 6 to 8, within the tube. *Style* short. *Ovary* 5-celled.—A small scaly shrub.

28. R. *anthopogon*, Don—the only species.

If from a consideration of the species themselves we turn to that of the country they inhabit, it will be found that a great part of it is characterized by perennial humidity, which is excessive during the summer months. It will be seen, also, that the degree of humidity varies in different parts of the country, and that the rain-fall is unequally distributed; also that elevation is to a great degree a relative term, equal altitudes having different climates in various parts of Sikkim, with a dissimilar vegetation. To explain these points, it is necessary to give some account of the natural features of the Sikkim Himalaya Mountains, which seem to be little known, or generally misunderstood by those who have sought information respecting the management of Rhododendrons, through the various horticultural periodicals. Except these points are clearly understood, it will be impossible to appreciate the conditions under which the species grow.

Sikkim is included in a section of the Himalaya Mountains about sixty miles broad from east to west, where it is bounded respectively by the mountain states of Nepal and Bhotan. Its southern limits are easily defined, for the mountains rise rather abruptly from the plains of Bengal, as spurs of 6000 to 10,000 feet high, densely clothed with forest to their summits. The northern and north-eastern frontier of Sikkim is beyond the region of Rhododendrons, and is not a natural but a political line, drawn between itself and Tibet. Sikkim is nearly due north of Calcutta, and only 400 miles from the sea at the Bay of Bengal; its latitude being 26° 40′ to 28° N., and longitude 88° to 89° E. The greater part of the country between Sikkim and the sea is a dead level, occupied by the delta of the Ganges and Burrampooter, above which the slope is so gradual to the base of the mountains, that the surface of the plain from which the Himalayas immediately rise is only 300 feet above the sea. The most obvious effect of this position is, that the prevailing southerly wind reaches the first ranges of hills loaded with vapour. The same current, when deflected easterly to Bhotan, or westerly to Nepal and the north-west Himalaya, is intercepted and drained of much moisture, by the Khassya and Garrow Mountains (south of Assam and the Burrampooter) in the former case, and the Rajmahal hills

(south of the Ganges) in the latter. Sikkim is hence the dampest region of the whole Himalaya.

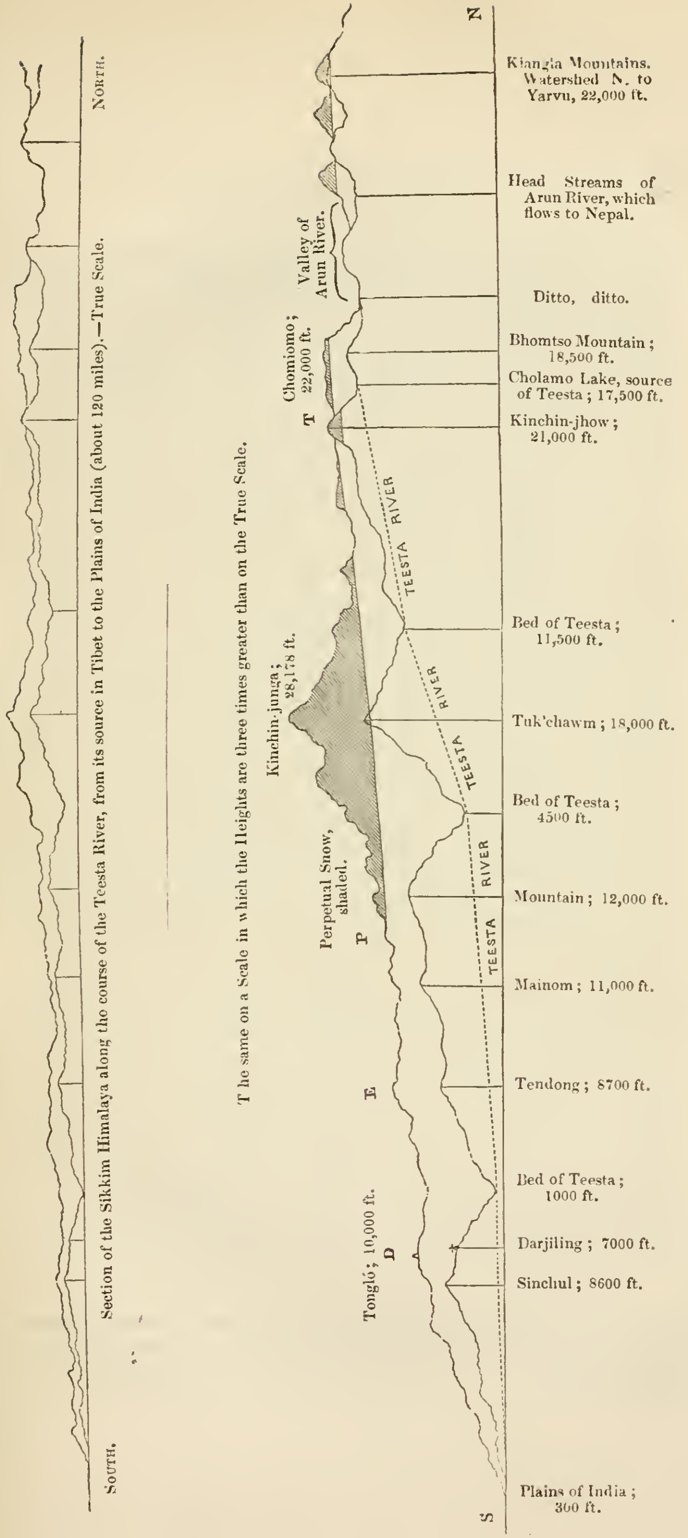
Viewed from a distance on the plains of India, Sikkim presents the appearance—common to all mountainous countries—of consecutive parallel (wooded) ridges, running east and west, backed by a beautiful line of snowy peaks, with occasional breaks in the foremost ranges, through which the rivers debouch. Any view of the Himalaya, especially at a sufficient distance for the distant snowy peaks to be seen overtopping the outer ridges, is very rare, from the constant deposition of vapours over the forest-clad ranges during the greater part of the year, and the haziness of the dry atmosphere of the plains in the winter months. At the end of the rains, when the S.E. monsoon has ceased to blow with constancy, views are obtained, sometimes from a distance of nearly 200 miles. The angle subtended by the giant peaks is so low (not a degree) that they appear like white specks very low on the horizon, tipping the black lower and outer wooded ranges, which always rest on a belt of haze, and from the density, probably, of the lower strata of atmosphere, are never seen to rest on the visible horizon. The remarkable lowness on the horizon of the whole stupendous mass is always a disappointing feature to the new comer, who expects to see dazzling peaks towering in the air. Approaching nearer, the snowy mountains sink behind the wooded ones long before the latter have assumed gigantic proportions, and when they increase in size, they appear a sombre, lurid grey-green mass of vegetation, with no brightness or variation of colour. There is no break in this forest caused by rock, precipice, or cultivation; some spurs project nearer, and some valleys appear to retire further into the heart of the first great chain that shuts out all the country beyond. No pines whatever are seen on the outer range of Sikkim, both soil and climate being far too damp in the rainy season; nor are the colours of the foliage so varied and bright as the more perennially humid forests of tropical shores, from the want of any abundance of such palms as *Caryota*, tall *Arecæ*, and of *Artocarpi*, or of orange-groves.

As it is not my purpose to discuss here the tropical, or lower zone of Sikkim, I shall at once transport the reader to the north side of the first range of mountains. From here it will be seen that the appearance of parallel ridges is due to the inosculating spurs of long tortuous ranges that run north and south throughout the whole length of Sikkim, dividing deep wooded valleys, which form the beds of large rivers. The snowy peaks still look like a long east and west range of mountains, at an average distance of 30 or 40 miles from the outer range. Advancing into the country, this appearance proves equally deceptive, and the range of snow

is resolved into isolated peaks, situated on the meridional ranges, at distances varying from 30 to 80 miles from the observer; their snowed spurs, projecting east and west, cross one another, and being uniformly white, and all brought by perspective into one line, they appear to connect all the peaks into one grand unbroken range of snow. The rivers, instead of having their sources in the snowy mountains, all rise far beyond them; many of their sources are upwards of 100 miles in a straight line from the plains, in a very curious country, loftier by far in mean elevation than the meridional ridges which run south from it, and though so lofty, comparatively unsnowed. This rearward mountain region is Tibet, and into it all the Sikkim, Nepal, and Bhotan rivers lead, up to a watershed whose discharge to the northward is into the Yarou-Tsampu river, which becomes the Burrampooter of Assam. Tibet is a very arid mountain mass, the southerly wind being exhausted of vapour by these long ridges long before reaching it. The maximum range in latitude and elevation of the Himalayan vegetation is determined very much by the length of the rivers, which, rising in Tibet as small streams, increase in size as they receive the drainage from the snowed parts of the ridges that bound them in their courses. Their banks, between 8000 and 14,000 feet, are generally clothed with Rhododendrons, sometimes to the almost total exclusion of other woody vegetation, especially near the snowed mountains—a cool temperature and great humidity being the most favourable conditions for the luxuriant growth of this genus.

The source of this humidity is the southerly or sea wind, which blows steadily from May till October in Sikkim, and prevails throughout the rest of the year, if not as the monsoon properly so called, as a current from the moist atmosphere over the Gangetic delta. This rushes north to the rarefied regions of Sikkim, up the great valleys, and does not appear materially disturbed by the north-west wind, which blows during the afternoon of the winter months over the plains, and along the flanks of the outer range, and is a dry surface current, due to the diurnal heating of the soil. When it is considered that this wind, after passing lofty mountains on the outer range, has to traverse 80 or 100 miles of alps before it has watered all the Rhododendron region, it will be evident that its moisture must be expended before it reaches Tibet.

Let the accompanying woodcut represent two of these long meridional ridges, from the watershed to the plains of India, following in this instance the course of the Teesta river, from its source at 19,000 feet to where it debouches from the Himalaya at 300. The lower rugged outline represents one meridional ridge, with all its most prominent peaks (whether exactly



Section of the Sikkim Himalaya along the course of the Teesta River, from its source in Tibet to the Plains of India (about 120 miles).—True Scale.

The same on a Scale in which the Heights are three times greater than on the True Scale.

or not on the line of section); the upper represents a parallel ridge, of greater mean elevation, further west, introduced to show the maximum elevation of the Sikkim mountains, Kinchinjunga (28,178 feet) (K) being represented on it. A deep valley is interposed between these two ridges, with a feeder of the Teesta in it, which runs south from Kinchin, and turning west enters the Teesta at R. The position of the bed of the Teesta river is indicated by a dotted line from its source at T to the plains at S; of Darjiling, on the north flank of the outer range, by D; of the first point where perpetual snow is met with, by P; and of the first indications of a Tibetan climate by C.

A warm current of air, loaded with vapour, will deposit the bulk of its moisture on the ridge (8000 feet) D. Passing on, little will be precipitated on E, whose elevation is the same as that of D, but much at F (10,000 feet), where the current being further cooled has less capacity for holding vapour than it had at D, and is further exhausted. When it ascends to P (15,000 feet) it is sufficiently cooled to deposit snow in the winter and spring months, more of which falling than can be melted during the summer, it becomes perennial. At K (20,000 feet) very little falls, and it is doubtful if the southerly current ever reaches the prodigiously elevated isolated summit of Kinchinjunga (28,178 feet);* but all that does, is evaporated or retained as snow. The amount of surface above 20,000 feet is, however, too limited and broken into isolated peaks to drain the already nearly exhausted wind current, whose condensed vapours roll along in fog beyond K, are dissipated during the day over the arid mountains of Tibet, and deposited at night on the cooled surface of the earth.

Other phenomena of no less importance than the distribution of vapour, and more or less depending on it, are the duration and amount of solar and terrestrial radiation. Towards S the sun is rarely seen during the rainy season, as well from the constant presence of nimbi aloft, as of fog on the surface of the ground. An absence of both light and heat is the result in the parallel of K; and at C low fogs prevail at the same season, but do not intercept either the same amount of light or heat; whilst at T there is much sunshine and bright light. During the night, again, there is no terrestrial radiation between S and P; the rain either continues to pour—in some months with increased violence—or the saturated atmosphere is con-

* I believe that the utmost elevation the S.E. monsoon attains is 23,000 feet, and that only where the whole mass of land is immensely elevated. A perennial westerly wind appears by the clouds' motions to blow at the top of Kinchinjunga.

densed into a thick white mist, which hangs over the redundant vegetation. A bright starlight night is almost unknown in the summer months at 6000 to 10,000 feet, but is frequent in December and January, and at intervals between October and May, when, however, vegetation is little affected by the cold of nocturnal radiation. In the regions north of K starlight nights are more frequent, and the cold produced by radiation is, at 14,000 feet, often severe towards the end of the rains in September. Still the amount of clear weather during the night is small; the fog clears off for an hour or two at sunset as the wind falls, but the cold north returning current chills the air again soon after, and rolling masses of vapour are hence flying overhead or sweeping the surface of the earth throughout the summer nights. In the Tibetan regions, again, bright nights and even sharp frost prevail throughout the warmest months.

Referring again to the cut, it must be borne in mind that neither of the two meridional ridges runs in a straight line, but that they wind or zigzag like all mountain ranges; and that spurs from each ridge are given off from either flank alternately, and that the head of a spur on one side answers to the source of a river (*i.e.*, the head of a valley) on the other. These rivers are feeders of the main stream, the Teesta, and run at more or less of an angle to the latter. The spurs from the east flank of one ridge cross, at their ends, those from the west flank of another; and thus transverse valleys are formed, presenting many modifications of climate with regard to exposure, temperature, and humidity.

The roads from the plains of India to the watershed in Tibet always cross these lateral spurs. The main ridge is too winding and rugged, and too lofty for habitation throughout the greater part of its length. The river channel is always very winding, unhealthy for the greater part of the year below 4000 feet, and often narrow, gorge-like, and rocky. Villages are always placed above the unhealthy regions, on the lateral spurs, which the traveller keeps crossing throughout every day's march; for these spurs give off lesser ones, and these again others of a third degree, whence the country is cut up into as many spurs, ridges, and ranges, as there are rills, streams, and rivers on the mountains.

Though the direction of the main atmospheric current is to the north, it is seldom in reality felt to be so, except the observer is on the very exposed mountain tops, or watches the motions of the upper strata of atmosphere. The lower currents of air rush up both the main and lateral valleys, throughout the day; and from the sinuosities in the beds of the rivers, and generally transverse directions of their feeders, the current often becomes an east or west one. In the branch valleys draining to the north

the wind still ascends; it is, in short, an ascending warm moist current, whatever course be pursued by the valleys it follows.

The sides of each valley are hence equally supplied with moisture, though local circumstances render the soil on one or the other flank more or less humid, and favourable to a luxuriant vegetation: such differences are a drier soil on the north side, with a too free exposure to the sun at low elevations, where its rays, however transient, rapidly dry the ground, and where the rains, though very heavy, are of shorter duration, and owing to the capacity of the heated air for retaining moisture day fogs are comparatively rare. In the northern parts of Sikkim, again, some of the lateral valleys are so placed that the moist wind strikes the side facing the south and keeps it very humid, whilst the returning cold current from the neighbouring Tibetan mountains impinges against the side facing the north, which is hence nearly bare of vegetation. An infinite number of local peculiarities will suggest themselves to any one conversant with physical geography, as causing unequal local distribution of light, heat, and moisture in the different valleys of so irregular a country —the amount of slope, and its power of retaining moisture and soil; the composition and hardness of the rocks; their dip and strike; the protection of some valleys by lofty snowed ridges, and the free southern exposures of others at great elevations.

One other peculiarity deserves especial attention, which is, the position of the great masses of perpetual snow. A reference to the woodcut will show that the same circumstances which affect the distribution of moisture and vegetation, determine the position, amount, and duration of the snow. The principal fall will occur, as before shown, where the meridional range first attains a sufficiently great elevation, and the air becomes consequently cooled below 32°; this is at a little above 14,000 feet, sporadic falls occurring even in summer at that elevation: this snow, however, melts immediately, as do the copious winter falls in the summer months. As the depth of rain-fall diminishes in advancing north to the higher parts of the meridional ranges, so does the snow-fall. Its permanence, again, depends on—1. the depth of the accumulation; 2. the mean temperature of the spot; 3. the melting power of the sun's rays; 4. the prevalence and strength of evaporating winds. Now at 14,000 feet, though the accumulation is immense, the amount melted by the sun's rays is trifling, and there are no evaporating winds; but the mean temperature is so high, and the corroding powers of the rain (which falls abundantly throughout summer) and of the warm and humid ascending currents are so great, that the snow is not perennial. At 15,000 feet, again, it becomes perennial, and its permanence at this low elevation (at P) is much favoured

by the accumulation and detention of fogs over the rank vegetation which prevails from S nearly to P; and by the lofty mountains of K, which shield it from the returning dry currents from the north. In proceeding north all the circumstances that tend to the dispersion of the snow increase, whilst the fall diminishes. At P the deposition is enormous, and the snow-line low—15,000 feet; whilst at T little falls, and the limit of perpetual snow is 19,000 and 20,000 feet. Hence the anomaly, that the snow-line ascends in advancing north to the coldest Himalayan regions. The position of the greatest peaks and of the greatest mass of perpetual snow being generally assumed as that of the ridge or watershed, travellers, arguing from single mountains alone, on the meridional ridges, have at one time supported, and at another denied, the assertion, that the snow lies longer and deeper on the north than on the south flank of the Himalaya ridge.

The great accumulation of snow at 15,000 feet, in the parallel of P, exercises a decided influence on the vegetation. The alpine Rhododendrons R. *setosum* and R. *anthopogon* hardly reach 14,000 feet, sometimes not 13,000 feet, in the broad valleys and round-headed spurs of the flanks of Kinchinjunga; whilst the same species ascend to 16,000, and one to 18,000 feet, at T. Beyond the latter point, again, the great aridity of the climate prevents their growth, and in Tibet there are generally none even as low as 12,000 and 14,000 feet. Glaciers, again, descend to 13,000 feet in the tortuous gorges which immediately debouche from the snows of Kinchinjunga, but no plants grow on the débris they carry down, nor is there any sward of grass or herbage at their base, the whole surrounding atmosphere being chilled by enormous accumulations of snow, and the summer sun rarely warming the soil. At T, again, the glaciers do not descend below 16,000 feet, but a green sward of vegetation creeps up to their bases, dwarf Rhododendrons cover the moraines, and herbs grow on the patches of earth they carry down, which are thawed by the more frequent sunshine, and by the radiation of heat from the unsnowed flanks of the valleys down which these icy streams pour.

Looking eastward or westward on the map of India, the phenomenon of the perpetual snow is regulated by the same laws. From the longitude of Upper Assam in 95° E. to that of Kashmir in 75° E. the lowest limit of perpetual snow is about 15,000 feet, and the mass of Rhododendrons affect the most humid localities near it, at 12,000 to 14,000. Receding from the plains of India and penetrating the mountains, the climate becomes drier, the snow line rises, and vegetation diminishes, whether the elevation of the land increases or decreases, plants reaching 17,000 and 18,000 feet, and the snow line 20,000 feet. To mention extreme cases: the snow level of Sikkim in 27° 30′ is at 15,000

feet, and of vegetation at 14,500; whereas in lat. 35° 30′ Dr. Thomson found the snow line 20,000 feet in Karakorum, and vegetation up to 18,000 feet—features common also to Sikkim in lat. 28°.

Of the Sikkim Rhododendrons I have little further to say except with reference to the individual species, and I shall therefore arrange these in three groups, according to the elevations they inhabit, adding such notes upon each as may prove useful in their determination and assist in their cultivation. No species that I am aware of extends much below 6000 feet in Sikkim, or in the Himalayas generally, though, according to Mr. Griffith, R. *arboreum* is found below 4000 on some of the dry rocky outer ranges of Bhotan. In this respect, however, the latter country is very exceptional, and demands a passing notice. The Khassya mountains, as I have elsewhere shown, shield the lower ranges of Bhotan from the effects of the southerly monsoon; they rise to an average height of 5000 feet, extending (as the Garrows, westward, and Jyntea hills, eastward) for about 250 miles parallel to and 60 miles south of the Bhotan Himalaya, the intervening valley being that of the Burrampooter river. The monsoon from the Bay of Bengal is in this longitude a S.S.W. one, and after traversing 200 miles, partly of the Sunderbunds and partly of a very peculiar marsh district called the Jheels, it discharges an amount of water on the abrupt southern face of the Khassya which, as a rain-fall, I believe has no parallel in the world, amounting to between 400 and 500 inches a-year. Suddenly deprived of one-third of its water, the current pursues its course northward, traversing 30 miles or so of hills, whereby it is cooled; while it is again warmed in the moist valley of Assam. What is thence carried on to the Bhotan Himalaya is not condensed on the mountains till it reaches a considerable elevation, 5000 feet and upwards, where it is cooled and deposits moisture abundantly. The Bhotan Himalaya is therefore very dry below 5000 feet, and humid above that, but never so much so as Sikkim.

R. *arboreum* is found at 4500 feet on the Khassya (but not near the southern edge of the range), and ascends to 7000 feet. There are several other Khassya species, all avoiding the southern parts, though one of them descends to 2000 feet on the north flank. Most of the species, as well as those of the Malay peninsula, Java, and Borneo, belong to the same section with R. *cinnabarinum*, having comparatively long tubes to the corolla and small calyces, or none.

The Borneo species* gathered by Mr. Low on Kini Balu,

* Many of these species will be figured shortly in Sir W. J. Hooker's 'Icones Plantarum.'

below 8500 feet, belong here; and I may conclude this long discussion with the remark, that though the Himalaya is so rich in species, it may prove that in this respect it only partakes of the flora of the Malay islands. Thirteen kinds found below 8500 feet, on a mountain unexplored beyond that height, and in a country but once ascended so high, argues a profusion of species in the mountainous regions of that island of which we can form no adequate idea.

I. Species of the First or Lower Zone, answering to the Temperate latitudes; 6000 to 10,000 feet.

1. R. *argenteum.*—Distribution and range: *East Nepal* and *Sikkim;* 8000 to 10,000 feet; confined to the dampest regions.

It forms a tree 30 feet high; trunks solitary, or two or three together, spreading, branched above, the bark pale, and the branches leafy at the apex. Leaves very beautiful in the leaf-buds, at first enveloped in erect and silky scales, so closely imbricated and so large as to resemble the cones of some species of pine; the outer or lower scales broad and coriaceous, glabrous, of a reddish-brown colour, the innermost ones oblong-spathulate, pubescent. When fully developed the leaves are among the largest of the genus, 6 inches to a foot long, 3 to 5 inches broad, full green above, beneath silvery white. Bracteas deciduous, densely silky. Flowers 2 to 3 inches long, 2 to 2½ inches in diameter, inodorous, always white.—In the silvery underside of the foliage, but in nothing else, this resembles R. *arboreum*, while the blossoms are often as large as those of R. *Dalhousiæ*. On Sinchul, the higher parts of the mountain, from 8000 to 9,000 feet of elevation, are more or less clothed with it; on Tongló, as it approaches 10,000 feet, it is suddenly replaced by R. *Falconeri*. It seemed to be shy of flowering in the season of 1848, for it was with difficulty I could then procure sufficient specimens to complete my drawing; in 1849 it flowered profusely, and, with the white magnolias, formed at a considerable distance a conspicuous object amid the lurid green vegetation of the mountains.

2. R. *barbatum.*—Distribution and range: *Kemaon, Nepal, Sikkim,* and *Bhotan;* 8000 to 11,000 feet; confined to the dampest wooded regions.

A tree 30 to 40 feet high, branched from the base. Leaves, in the very young state, sparingly hairy and ciliated; when fully developed, 5 to 7 inches long, and from 1½ to 3 inches wide, elliptical-lanceolate, acute, rather broader above the middle,

the margins reflexed and rough from the presence of small harsh hairs; the nerves sunk on the upper surface; dull but full green above, paler and quite glabrous beneath, and destitute of scales or down. Petioles sometimes quite deprived of hairs. Flowers moderately sized, blood-colour, collected into a compact globose head 4 to 5 inches in diameter. Bracteas oblong or ovate, the inner ones silky, all more or less glutinous.—One of the most beautiful of the Himalayan species, but variable in size and habit. I have seen it forming a low shrub in mossy swamps, and then entirely destitute of bristles on the leaf and flower stalks; in such a state it was figured and described as R. *lancifolium*.

3. R. *arboreum*.—Distribution and range: *throughout the Himalaya*. 5000 to 10,000 feet. Most frequent in the drier valleys and ridges.

Of this well known species no description is necessary: it abounds in the inner ranges of Sikkim, descending to 5000 feet beyond the first great ridge; on that ridge, on the other hand, it is very rare, never descending below 7500 feet, and only appearing in exposed places. It prefers a drier soil and locality than most other species. The leaves are very variable in shape and in the form of their base, which tapers into a foot-stalk or is cordate; their under surface is generally silvery white, but as the species attain higher elevations they become yellower, and finally rusty underneath, as in the variety *Campbelliæ*. The seedlings partake of the habit, colour, and texture of their parents in a remarkable degree, whence the difficulty of recognizing R. *arboreum* under several very common forms in our nurseries. A jelly is made from the flowers of this plant in the N.W. Himalaya, but I have never seen the preparation. The honey of wild bees is at the flowering season said to be poisonous in Sikkim, but opinions are divided as to whether R. *arboreum* or R. *Dalhousiæ* is to blame; if either, I suspect it to be the former, which alone is abundant near the localities where the bees abound.

After a very careful examination I have come to the conclusion that the R. *Campbelliæ* is only a variety of this; and I further include the R. *nobile*, Wall.; R. *Nilagaricum*, Zenker; and R. *Zeylanicum*. Its geographical distribution is therefore Ceylon, the peninsula of India, the Khassya mountains and the Himalaya mountains from Upper Assam nearly as far west as the Indus; between the elevations of 5000 and 10,000 in Bhotan, Sikkim, Nepal, and Kemaon, but only between 5000 and 7000 elsewhere. It is not found in the valley of Kashmir, but on the south flanks of the mountains bounding that valley on the south.

4. R. *niveum.* — Distribution and range: *Sikkim* — 10,000 to 12,000 feet—in moist valleys of the interior.

This species forms a tree so similar to R. *arboreum*, that I much doubt its being distinct. The snowy white down is peculiar, as are the short capsules, and in my ignorance of the flowers I rest its claims upon these characters alone. I have not recognized young plants in cultivation.

5. R. *Dalhousiæ.*—Distribution and range: *East Nepal*, *Sikkim*, and *Bhotan* (Griffith)—6000 to 9000 feet—in humid forests, generally growing on limbs of trees.

The seeds of this species have germinated as freely as any, and the young plants are making rapid progress in a cool moist house. The young leaves are very hairy, which character and their tenderness distinguish them. They most resemble R. *ciliatum*, but the latter is more hairy, of a darker colour, and rigid texture.—A straggling shrub, 6 to 8 feet high, generally growing, like tropical Orchideæ, among moss, with ferns and Aroideæ, upon the limbs of large trees: the stems clothed with a reddish, papery bark, the branches straggling in distant whorls; each branch bearing its leaves and flowers only at the extremity. Leaves few, spreading or reflexed, about 4½ to 5 inches in length, footstalk about ½ an inch long, the margin plane (not revolute), the upper surface darkish green, inclining to yellow; beneath paler, dotted with very small, scattered, rusty-coloured scales. Flowers 3 to 7 in a terminal, umbellate head, the spread of which is greater than that of the leaves. Corolla 3½ to 4½ inches long, and as broad at the mouth; at the contracted base of the tube are 5 deep pits. Lobes of the limb nearly equal, very broad, rounded, waved, spreading. The flowers are white, with an occasional tinge of rose, in size and colour almost resembling those of the white Bourbon Lily (*Lilium candidum*); in age they assume a delicate roseate tinge, and sometimes become spotted with orange, which rather adds to their beauty than detracts from it. They are lemon-scented, and very fragrant.

6. R. *Griffithii.*—Distribution and range: *Bhotan* and *Sikkim*—7000 to 9000 feet—in the valleys and ridges of the interior only, where the climate is drier.

It forms scattered bushes, 4 to 8 feet high, branching from the base, where the trunk is 6 inches in diameter. Branches suberect, copiously leafy. Bark smooth and papery. Leaves variable in size and breadth, but large for the size of the plant, 4 to 10 inches long; margin plane, often tinged with yellow; upper

surface light full green; the under paler, slightly glaucescent. Flowers the largest of the genus, variable in size, terminal, 3 to 5 together, inodorous. Peduncles rather slender, longer than the petioles, red or green. The calyx represents a shallow, concave, irregular, subrhomboid-shaped platter, 1½ inch in its greatest diameter; the back marked with slightly elevated, radiating lines, glossy, as if varnished. Corolla white, tinged with pink, veiny, of a firm, rather fleshy texture: tube short for the size of the flower, yellowish and rose-colour towards the base, the mouth very wide, lobes exceedingly large and spreading. I have measured some only 3 inches across, but others 5 and 5½ inches in diameter!—I have found but few plants of this superb species, and in these the inflorescence varied much in size. The specimens from which the drawing in Sikkim Rhod. (under the name of *R. Aucklandii*, Pl. XI.) was made were from a bush covered with blossoms, growing in a rather dry, sunny exposure, above the village of Choongtam. The same species also grows on the skirts of the pine-forests (*Abies Brunoniana*) above Lamteng, and it is there conspicuous for the abundance rather than for the large size of its blossoms.

When I described this plant I was not aware of its being the R. *Griffithii* of Dr. Wight's Icones Plant. Ind. Or., the drawing of which seems to have been prepared from very bad materials. The great size of the corollas figured in the "Sikkim Rhododendrons" may be due to the individual being sterile, for I found the anthers to contain little or no pollen.

7. R. *Edgeworthii*.—Distribution and range: *Sikkim*—7000 to 9000 feet—in forests of the dampest regions.

Leaves 2 to 4 inches long. Corolla white, often tinged with blush or pale yellow: the tube rather short, widening much at the mouth, slightly curved, the limb unusually large, more than 4 inches across, spreading, of 5 nearly equal, rounded, slightly emarginate lobes, crisped at the margin, delicately veined on the surface.—A truly superb species, from the size of the flowers and their roseate tinge on a white ground, also from the variety of rich colour in the leaves, bracteas, stipules, calyx, &c., while the very wrinkled surface of the leaf adds much to its beauty. In its floccose character and foliaceous calyx it resembles *R. pendulum;* but in the size and shape of the flowers it approaches R. *Dalhousiæ*, next to which I would place it. The majority of my specimens were obtained from the land-shoots or slips in the rocky ravines, which bring down in their course those pines on the limbs of which this species delights to grow.

8. R. *Maddeni.* — Distribution and range: *Bhotan* (?) and *Sikkim*—where it was found in the inner and drier valleys only, and very rarely there, at 6000 feet elevation.

A shrub 6 to 8 feet high. Leaves abundant, of a coriaceous substance but flaccid, 4 to 7 inches long, frequently pendulous. Corolla $3\frac{1}{2}$ to 4 inches long, and as much across the limb, very handsome, white with a faint blush chiefly on the upper lobe, rather fleshy, but firm in substance; in shape much more contracted than is usual with the Himalayan species: the limb very large, spreading, of 5 nearly equal, rounded, entire lobes, slightly crenato-undulate at the margin, delicately but obscurely veined. The foliage and flowers are faintly odorous.

This species clearly belongs to the same natural group as R. *cinnabarinum;* from which, however, the very large white flowers, the numerous stamens, and ten-celled fruit abundantly distinguish it.

9. R. *ciliatum.* — Distribution and range: *Sikkim* — 9000 to 10,000 feet—in rocky valleys of the interior.

This forms a small very rigid shrub, growing in clumps 2 feet high, generally in moist rocky places. Odour faintly resinous and pleasant. Corolla $1\frac{1}{2}$ inch long, nearly as much across at the mouth; tube rather contracted below, limb 5-lobed, colour pale reddish-purple; upper lobe obscurely spotted. Allied to R. *barbatum*, but widely different in stature, habit, and the scattered scales on the under surface of the leaves. I have not observed it in other valleys than those flanked by snowy mountains, where it is common, scenting the air in warm weather. The scales (as in its congeners) are orbicular, sessile, attached at the centre, formed of 3 concentric series of cells surrounding a central one, in which a resinous fragrant oil is secreted.

10. R. *virgatum.*—Distribution and range: *Bhotan* and *Sikkim*—7000 to 9000 feet—in damp valleys of the interior.

Under this I have included two species figured in the "Sikkim Rhododendrons" which are perhaps only extreme varieties. The characters common to both are a slender twiggy habit, a height of 3 to 6 feet, glaucous leaves, and a perfect identity in all essential characters of inflorescence and fruit. The shape of leaf is a variable one in all cases, as are the size and colour of flower, upon which characters R. *triflorum* was founded. The latter is by far the handsomer plant, and grows at lower elevations. The following remarks apply to it:—

Var. *triflorum* forms a shrub 4 to 6 feet high, with erect and rather twiggy branches. Leaves frequently pendulous, on rather short, slender petioles ($\frac{1}{3}$ of an inch long), ovato-lanceolate, approaching to oblong or elliptical, 2 or 3 inches long, the margin a little recurved, substance rather thin, upper surface smooth and shining, under quite glabrous and glaucous, but so beset with ferruginous scales as to partake of that colour. Peduncles generally 3 together, terminal, $\frac{1}{2}$ to $\frac{3}{4}$ of an inch long, slender, erect. Corolla greenish-yellow, in shape much resembling that of the common garden Azaleas, having a somewhat obconical tube very open at the mouth, and a limb of 5 spreading oblong entire segments, which are slightly veiny, nearly 2 inches across the lobes.

R. *virgatum* itself has stems and branches 4 feet high, scarcely the thickness of a crow-quill. The leaves are in form and size like those of *R. glaucum.* Flowers solitary, rarely in pairs, and axillary; the pedicels 2 to 3 lines long, covered with sheathing, deciduous, coriaceous, brown scales, which are longer than the pedicel, very rigid in texture, downy on the back. Corolla a pale red-purple, smaller than that of Var. *triflorum*, but of the same form; the tube short, narrow, and obconical, the segments narrow and spreading.

11. R. *vaccinioides.*—Distribution and range: *Sikkim* —6000 to 8000 feet—in very moist situations of the outer and inner valleys.

The flowers of this species were unknown to me when I published the second Fasciculus of the "Sikkim Rhododendrons," and I consequently placed the species in a wrong section of the genus. An excellent drawing, prepared by my friend the late Mr. Cathcart, represents the flower and fruit; it will shortly be published in Sir W. Hooker's Icones Plantarum. In the synoptical account of the species given above I have associated it with R. *camelliæflorum*, &c., with which it further agrees in its frequently epiphytical habit. It is not now alive in this country, and, being of no beauty, it may be long before it is so. In the neighbourhood of Darjiling it is very abundant.

A small, very slender, straggling species, sometimes pendulous from trunks of trees, and then 2 feet long, of a bright green colour, and so like a common Sikkim species of Vaccinium (V. *obovatum*, Wight, Icon., t. 1193) as not to be distinguishable at first sight. Stems no thicker than a dove's quill, rough with tubercles, indicating the former position of scales, which still clothe the branchlets, petioles, and more sparingly the under surface of the foliage. Leaves coriaceous, $\frac{3}{4}$ to an inch long, obovate or even spathulate, the blade narrowed downwards to

the very point where it meets the stem; upper surface a bright green, lower paler. Flower-stalks as long as the leaves, slender. Flowers nodding, white, nearly half an inch across, of the same form as those of R. *setosum* and R. *lepidotum*, having a short, swelling, almost spherical tube, and spreading or recurved round lobes. Stamens projecting far beyond the tube. Seed-vessels curved, unlike those of any other species, being slender and membranous, pale-brown, an inch long, scarcely $\frac{1}{8}$ in diameter, valves linear, a little scaly on the back.

II. Species of the Middle or Alpine Zone, answering to the Alpine region of Southern and the Subalpine of Middle and Northern Europe, to the climates of the Scotch Fir, &c. (10,000 to 14,000 feet).

12. R. *Falconeri.*—Distribution and range: *East Nepal* and *Sikkim*—9000 to 12,000 feet—in moist forests.

A tree 30 feet in height; 2 or 3 trunks springing from the same point, often 2 feet in diameter. Bark pale and smooth; branches few, spreading, leafy at the tops; young leaves clothed with velvety down, and when in bud concealed by downy glutinous scales, of which the outer are subulate, the inner ovate. The perfect leaves are very coriaceous, from 8 to 20 inches long, and 5 to 12 inches wide, the upper side glossy green, but fading into yellow at the margins, which are quite plane (not recurved) beneath; clothed with a short, dense, pale, ferruginous down, except on the mid-rib and reticulated veins. Leaf-stalks long and very thick, plane and glabrous above, clothed beneath with dark rusty down. Heads small, composed of numerous white, densely placed flowers. This is a most striking and distinct species, of which the foliage resembles the ferruginous-leaved *Magnolia grandiflora*. The dense many-flowered head, the multiplication of the lobes of the corolla, and of the stamens and fruit-cells, and the exserted style, bring it very near R. *grande* (Wight's Ic. Pl., vol. iv., t. 1202), a Bhotan species found by Mr. Griffith; but the foliage is totally different.

The flowers and leaves of this species usually attain a much larger size than those represented in the "Sikkim Rhododendrons."

13. R. *Hodgsoni.* — Distribution and range: *East Nepal*, *Bhotan*, and *Sikkim*—10,000 to 12,000 feet—in humid forests.

A small tree, from 12 to 20 feet, branching from the base,

main branches as thick as the human thigh, spreading horizontally 20 or 30 feet every way, interwoven with the adjacent plants and shrubs. Bark smooth, pale flesh-coloured, flaking off in broad membranous patches. Wood white, very close-grained, soft yet tough, neither warping nor splitting, but, in consequence of the great compression of the larger branches, rarely affording a sample a foot square. Leaves terminal on the end branches, ample, spreading, 12 to 18 inches in length, of a singularly thick coriaceous texture, glabrous and bright glossy green above; beneath, all except the thickened costa, clothed with a pale silvery white, rarely ferruginous, closely appressed wool, but which is easily rubbed off by the finger, and is often itself evanescent. Heads 4 to 6 inches in diameter, of several delicate, pale purple or rose-coloured flowers. Flower-stalks short, viscid, often downy. Corolla large, the tube 1½ inch long, broadly campanulate, the base depressed at the insertion upon the flower-stalk, the margin of the depression lobed, limb spreading, 2 to 2½ inches across, 8-lobed. This, and its associate the *Abies Webbiana*, I have always regarded as characteristic plants of 10,000 to 12,000 feet in all the interior parts of Sikkim. *R. Hodgsoni*, in this respect, ranks with *R. arboreum* and *R. Campbelliæ*, being found in a loftier zone of Rhododendrons, succeeded by the arctic one of *R. anthopogon*, *R. setosum*, *R. elæagnoides*, and finally, far above the ordinary limit of phænogamic vegetation, by *R. nivale*, which is found at an elevation of 18,000 feet. Within the limits assigned to the present species, the traveller's attention is continually arrested by its magnificent and brilliant deep green foliage, as large as that of *R. Falconeri*. In summer the leaves spread all around the plant; in winter they are rolled up, shrivelled, and pendulous from the tips of the branches. It is found alike at the bottom of the valleys, on the rocky spurs or slopes of the hills, in open places, or in the gloomy pine-groves, often forming an impenetrable thicket, not merely of twigs and foliage, but of thickset limbs and stout trunks, only to be severed with difficulty, on account of the toughness of the wood. As it is easily worked, and not apt to split, it is admirably adapted for use in the parched and arid climate of Tibet; and the Bhoteas make from it cups, spoons, and ladles, and the saddle, by means of which loads are slung upon the "yak." The leaves are employed as platters, and serve for lining the baskets which contain the mashed pulp of *Arisæma* root (a kind of Colocass); and the customary present of butter or curd is always enclosed in this glossy foliage.

14. R. *Thomsoni* (and R. *candelabrum*). — Distribution and range: *East Nepal* and *Sikkim*—11,000 to 13,000 feet—in moist valleys.

A bush 6 to 10 feet high, or in damp woods 15 feet, but then spare and woody. Lower branches stout, a foot in diameter; upper slender, leafy at the extremities. Leaves 2 to 3 inches long, very broad, much resembling those of R. *campylocarpum*, only that in the latter the leaf-stalks are often glandular, here never; the texture of the leaves is coriaceous, but not very thick, the colour pale green, below sub-glaucous, everywhere quite glabrous. Flowers in a head of 6 or 8 together from the ends of short branches among the leaves, on stalks an inch or more long, which radiate, as it were, from a centre, spreading horizontally, or curving downwards. Corolla remarkable for its almost unrivalled deep blood-red colour and glossy surface, yielding only to R. *fulgens;* deeper coloured than that of R. *arboreum;* the tube elongated, often vertically compressed, 2 inches long; the limb large, spreading, 5-lobed, the lobes notched, upper ones spotted. This species is perfectly inodorous. In the base of the corolla is secreted much honey, which is not considered poisonous, like that yielded by R. *Dalhousiæ* and R. *argenteum*. The two latter species are said to render deleterious the wild honey which is collected during their flowering season.

15. R. *Wightii*.—Distribution and range: *East Nepal* and *Sikkim*—12,000 to 14,000 feet—alpine valleys, abundant.

A small shrubby tree, yielding, in beauty of inflorescence, to none amongst the yellow-flowered group to which it belongs. The trunks are often as thick as the thigh, and branch very much both upwards and outwards, forming a thickset shrub of 10 feet high. Leaves 6 to 8 (rarely 10) inches long, 2½ to 3 broad, very coriaceous, more plane than is usual in the genus, bright green above, beneath covered with a very closely appressed opaque wool of a deep rufous colour, rarely pale and nearly white in the young foliage. Heads much larger than those of R. *arboreum*, 12 to 20-flowered, the flowers not densely packed. Bracteal scales chesnut-brown, very coriaceous and viscid. Flowers have a faint honeyed smell; foliage inodorous. This exceedingly handsome and abundant species replaces the R. *Hodgsoni* in ascending the mountains, and is the most prevalent species at 12,000 and 13,000 feet, conspicuous at all seasons for its large foliage, of a rusty cinnamon-colour beneath, and for its viscid buds.

16. R. *campanulatum.* — Distribution and range: *Kemaon*, *Nepal*, *Sikkim*, and *Bhotan*—10,000 to 14,000 feet—where it is abundant in all parts of Sikkim.

This well-known species is commonly cultivated in our gardens, and requires no particular description. It is wholly inodorous, and the flowers are very variable in colour, being of a deeper or paler lilac, often spotted inside the corolla. The variety I have called *Wallichii* is nearly destitute of wool on the undersurface of the leaf, and R. *æruginosum*, another variety, differs only in the purple capsules and curious verdigris-green colour of the young foliage. This and the following are the great ornaments of regions above 12,000 feet, where they often cover the flanks of the valleys with their rich green foliage and gaudy blossoms.

17. R. *fulgens.* — Distribution and range: *Sikkim* — 12,000 to 14,000 feet—in the valleys of the interior.

This superb species vies with R. *Thomsoni* in the colour of its dense capitula of flowers. The foliage entirely resembles that of R. *lilacinum*, the flowers those of R. *arboreum*.

18. R. *lanatum.* — Distribution and range: *East Nepal* and *Sikkim*—10,000 to 12,000 feet.

A large shrub or small tree, with the trunk 6 inches in diameter at the thickest part, irregularly and repeatedly branching; branches much gnarled and bare of leaves, covered with a dark-coloured rugged bark, very different from the prevailing beautiful papery clothing of the genus; where it breaks off from the younger branches, however, it exposes a delicate pink inner bark, whilst the branchlets are densely clothed with a soft, appressed cottony wool. The latter, generally of a white or tawny colour, is uniformly spread over the leaf-stalks, flower-stalks, ovary, and the under surface of the leaves, also extending to the upper surface, along the midrib, and to the very base in a less degree. The leaves are confined to the ends of the branches, $3\frac{1}{2}$ to 5 inches long, by about 2 inches broad, obovate or elliptical, obtuse, the colour a full yellowish green. Leaf-stalks short, thick, very woolly. Heads terminal, of 6 to 10 rather large, inclined flowers. Flower-stalks $1\frac{1}{2}$ inch long, thickened. Corolla ochroleucous or pale sulphur-colour: the tube broad-campanulate (like that of R. *Wightii*); within, above, and 3 of the upper lobes in part sprinkled with red dots; limb 2 to $2\frac{1}{2}$ inches across, of 5 nearly equal, very spreading, rounded, entire, obtuse lobes. In the dense wool on the under side of the leaves, this species may be compared with R. *fulgens* and R. *æruginosum* among the

large shrubby kinds, and with R. *Edgeworthii* and R. *pendulum* among others.

19. R. *campylocarpum*.—Distribution and range: *East Nepal* and *Sikkim*—11,000 to 14,000 feet—common in alpine valleys.

A small bush, averaging 6 feet in height, rounded in form, of a bright green hue, and which, when covered with its delicate inflorescence, claims precedence over its more gaudy congeners, and has always been regarded by me as the most elegant of the Sikkim Rhododendrons. The flowers have a pleasant honeyed scent, and a resinous, sweet odour is exhaled from the stalked glands of the leaf and flower stalks, calyx, and capsules. Leaves on slender stalks, $\frac{3}{4}$ of an inch long, coriaceous but not thick in texture, 2 to $3\frac{1}{2}$ inches long, $1\frac{3}{4}$ to 2 inches broad; in all characters, except the evanescent glandular hairs and spherical buds, undistinguishable from those of R. *Thomsoni*. Flowers horizontal and nodding. Corolla campanulate, delicate in texture, tinged of a sulphur hue and always spotless, nearly 2 inches long, broader across the lobes, which are finely veined. The stalks of the capsules radiate horizontally from the ends of the branchlets, and the capsules themselves curve upwards in a semicircular arc; they are about an inch long, always loosely covered with stalked glands.

20. R. *cinnabarinum*. — Distribution and range: *East Nepal*, *Sikkim*, and *Bhotan*—10,000 to 12,000 feet—in valleys and on the tops of mountains in very damp regions.

Under this species I include R. *Roylei* of the 'Sikkim Rhododendrons.' Neither of the figures give a good idea of the plant, which forms a rather elegant bush, about 8 feet high, conspicuous in May and June from its elegant blossoms, which form very loose and graceful heads of long pendulous flowers. The figures of R. *cinnabarinum* and R. *Roylei* are from stunted specimens growing in very exposed situations; the leaves are not usually reticulated except under these circumstances, and are rather membranous, of a glaucous green below and rather bluish above. Flowers, 4 to 6 in a head, $1\frac{1}{2}$ inch long, with a narrow, funnel-shaped tube, and slightly spreading broad lobes, which are sometimes rather sharp at the point. It is universally considered poisonous to cattle and goats: of the latter I have seen many die from eating either of this or of a species of *Andromeda*, which latter is notorious for this property throughout Sikkim, Nepal, and N.W. Himalaya. If employed as fuel, the smoke causes the eyes to inflame and the cheeks to swell.

21. R. *glaucum*.—Distribution and range: *Sikkim* and *Bhotan*, in moist rocky places. 10,000 to 12,000 feet.

This constitutes a small shrub of the average height of 2 feet. Branches scarcely so thick as a goosequill, yellowish-brown, often glaucous-white, the younger ones scaly. Leaves rather crowded at the extremities of the branches, 1 to 3 inches long, usually 1 to 1½ inch broad, on short stalks, upper side deep green, when old naked above, below remarkably glaucous, almost white, and quite dotted with copious little scales, which in the young state cover the whole leaf, and at all times abound on the bracteas, bud, flower-stalks, and especially on the sepals. Flower-stalks 7 to 8, almost in an umbel at the ends of the branches, erect, an inch or more long, rather slender. Flowers erect or inclined, pale pinkish-purple. Corolla rather more than an inch long, and about as broad in the widest part, tube campanulate, limb moderately spreading, of 5 nearly equal rounded notched lobes. The remarkable glaucous colour of the underside of the leaves, and the great development of the calyx, readily distinguish this species. In foliage it closely resembles R. *virgatum*, but the inflorescence and calyx are widely different. The whole plant has a powerful resinous smell, due to exceedingly small globules of a pale yellow colour which exude from beneath the little scales on the underside of the leaves. These scales are very curious; the majority are smaller, pale-coloured, exhibiting several concentric circles of small, nearly uniform cells; the larger are bristly at the margin, and consist of a centre or disc of small cells surrounded by a limb or margin of radiating elongated ones.

22. R. *pumilum*.—Distribution and range: *Sikkim*.—Alpine slopes. 12,000 to 14,000 feet.

The smallest of all the Sikkim Rhododendrons. Its slender woody stem roots among moss, *Andromeda fastigiata*, &c., ascends obliquely, and bears a few spreading branches, 3 to 4 inches in length, rising above the surrounding vegetation. Leaves, chiefly from the upper ends of the branches, ½ to ¾ of an inch long, bright bluish-green above, below scaly, as is the short stalk, and glaucous. Flower-stalks moderately slender, erect, 1 to 3 on the ends of the branches, and rising 1½ inch above the base of the superior leaves, firm and woody, much elongated, and straight to the very top when in fruit. Flowers inclined or almost drooping. Corolla ½ to ¾ of an inch long, rose-colour, campanulate, very delicate, externally downy, and obscurely glandular; the tube rather broad, the limb of 5 nearly equal, moderately spreading, roundish entire lobes. An extremely elegant species,

and apparently very rare; for I have only gathered it twice, and each time in the wildest districts of Sikkim, where its elegant flowers appear soon after the snow has melted, when its pretty pink bells are seen peeping above the surrounding short heath-like vegetation, reminding the botanist of those of *Linnæa borealis*. It has a faint and agreeable odour like that of R. *glaucum*, to which it has many points of resemblance.

23. R. *camelliæflorum*.—Distribution and range: *East Nepal*, *Sikkim*, and *Bhotan*.—In moist fir woods.—9000 to 12,000 feet.

This very curious species is more allied, in some respects, to the section including R. *lepidotum* than to any of the others; in foliage it resembles R. *Maddeni*, though much smaller; and also R. *cinnabarinum*, from which the dried flowerless specimens are not easily distinguishable. The same very stout midrib, which runs through and forms the point of the leaf, is common to all these. Stems 2 to 6 feet long, seldom thicker than a goose-quill; branches long, generally pendulous, though when growing on cliffs often obscurely so. Leaves, as usual in the genus, at the ends of the branches, differing in little but size from those of R. *Maddeni*, 2½ to 3 inches long. Flower-stalks axillary or terminal, very short and stout. Corolla sparingly scaly, 1½ inch across, of a very thick texture, pure white with a faint rosy tinge, all the segments obtuse and entire. The similarity between the flower and that of a single (wild) *Camellia* has suggested the trivial name. Odour, as in all the scaly species, more or less strongly resinous according to the heat of the day.

24. R. *pendulum*.—Distribution and range: *Sikkim*.—9000 to 11,000 feet.—In humid forests.

Stems 3 to 4 feet long, sparingly branched, branches scarcely stouter than a crow's quill. Leaves chiefly confined to the ends of the branchlets, on short stalks, spreading, smooth and shining above, the margins a little recurved, 1½ to 2 inches long and about ¾ of an inch broad, below densely clothed with ferruginous wool. Flower-stalks 2 to 3 from the ends of the young leafy branches, very short, but longer than the leaf-stalks, ferruginously shaggy, bearing 1 or 2 linear bracteas. Flowers small. Corolla pure white, about an inch in diameter, externally scaly, tube very short, gradually expanding into the nearly equally 5-lobed limb: lobes rounded, waved at the margin, entire. This species is inodorous, very distinct, although allied to R. *camelliæflorum*, the scaly character of that species here giving place to a dense fulvous or ferruginous wool. Growing, as it

does, an epiphyte, upon the trunks of trees in the gloomy and impenetrable forests, it is difficult to find.

III. Species of the Upper or Arctic Zone, from 14,000 to 18,000 feet, answering to the Arctic latitudes beyond the wooded regions, the islands of the Polar Seas, Iceland, Spitzbergen, &c.

25. R. *lepidotum*.—Distribution and range: *Rocky mountains and valleys in Nepal, Sikkim*, and *Bhotan*.—8000 to 16,000 feet. R. *lepidotum elæagnoides, oboratum*, and *salignum*, of the 'Sikkim Rhododendrons.'

This curious and very variable species abounds at 14,000 to 15,000 feet, but also extends as low as 8000 feet in moist valleys. It forms a slender or stout twiggy shrub, 1 to 4 feet high, branching from a stout tortuous stock; the branches as thick as a crow-quill, rather scattered, bearing tufts of branchlets at the top. It often grows in widely-extended clumps, much as heather does, but never so extensively; and emits, in sunshine, a powerful resinous odour. Leaves of a pale glaucous green, lighter underneath, and sometimes ferruginous where the scales abound; ½ to 1½ inch long. Flower-stalks more or less elongated, 1½ to 2 inches long, slender. Corolla yellow or dirty purple, ½ an inch across the lobes; scaly, especially on the outside of the tube; the upper lobes are spotted with green.—The odour of this plant is strongly resinous, and rather sweetish and pleasant. Its common name is "Tsaluma," or "Tsuma," amongst the Bhoteas. The description in De Candolle (Prodr., vol. vii., p. 724), if, as I do not doubt, it refers to this plant, is very erroneous. The leaves cannot be called "ferruginous below," in the same sense as applied to R. *anthopogon*, &c., nor are there any bristles or hairs at the bases of the leaves; nor have I observed more than 8 stamens, the typical number in this very distinct group.

26. R. *anthopogon*.—Distribution and range: *Kemaon, Nepal*, and *Sikkim*—12,000 to 16,000 feet—abundant, especially in the drier climates.

This interesting species has been figured from plants introduced by Dr. Wallich, which flowered in England. It is a strongly and far more disagreeably scented plant than R. *setosum*. This, the *Palu* of the Bhoteas, shares with the *Tsallu* (R. *setosum*) the blame of exciting the dreaded headache and nausea attending ascents to the elevations of the Eastern Himalaya. In the Herbarium its permanent odour is more disagreeable than that of any of the genus. Its flowers are extremely beautiful, both from the membranaceous, translucent texture of

the delicately nerved corolla, and from the varied tints of the blossoms, which on first opening are of a rich blush-colour, insensibly passing into pure white, and finally becoming faintly tinged with sulphur.

27. R. *setosum.* — Distribution and range: *Kemaon*, *Nepal*, and *Sikkim* — 13,000 to 16,000 feet — most abundant in the drier valleys of the interior.

Stems from 8 to 12 inches high, much branched, branches covered with a papery bark. Leaves small, copious towards the ends of the branches, $\frac{1}{3}$ to $\frac{1}{2}$ an inch long, coriaceous, dark green above, pale and glaucous beneath, hairy on the recurved margin. Flower-stalks $\frac{1}{2}$ to 1 inch long, 3 to 5 from the ends of the numerous branches, erect. Corolla bright red rose-colour, $1\frac{1}{2}$ inch across, 5-partite, the tube very short; the lobes spreading, oblong, waved at the margin.—A small and elegant shrub, resembling *Rhodora*, especially in the flowers, except that these are more abundant and brighter coloured; and the foliage is box-like and evergreen. It is the *Tsallu* of the Sikkim Bhoteas and Tibetans, who attribute the oppression and headaches attending the crossing of the loftiest passes of Eastern Himalaya to the strongly resinous odour of this and of R. *anthopogon*, Wall. (*Palu* of the natives). The species certainly abounds near the summits of all the passes, and after hot sunshine fills the atmosphere with its powerful aroma, far too heavy to be agreeable, and greatly aggravating the discomforts of toiling in the rarefied medium of these elevations. In its late flowering (June and July) and early fruiting (October) it is well adapted to the brief and distinctly circumscribed summer of these regions; whilst its powerful odour and copious resinous secretions equally indicate a drier climate than is enjoyed by most of its congeners. The hand, on being passed over the foliage and branches, becomes covered with the clammy exudation, of which it long retains the scent. A useful volatile oil, of no less marked a character than that of the American *Gaultheria* (now in great demand by the perfumers), might probably be obtained from the foliage by distillation.

28. R. *nivale.*—Distribution and range: *Sikkim Himalaya*—in the dry valleys of the interior—at elevations of 16,000 to 18,000 feet.

The hard woody branches of this curious little species, as thick as a goosequill, straggle along the ground for a foot or two, presenting brown tufts of vegetation where few other plants can exist. The branches are densely interwoven, and wholly depressed, being raised barely 2 inches above the soil. The surface

of the branchlets and foliage is covered by small scales of a rather bright ferruginous-brown. Leaves $\frac{1}{6}$ to $\frac{1}{8}$ of an inch long, pale green. Corolla $\frac{1}{3}$ of an inch across the lobes, of a purple colour. The whole plant is very odoriferous. It appears indifferent to the changes of climate, remaining buried under many feet of snow for eight months of the year; whilst at other periods the soil around it is heated to 150°. In the most genial weather snow-storms are of frequent occurrence; they do not, however, injure its blossoms, which remain open until fertilization has taken place. This species attains, I believe, a loftier elevation than any other shrub in the world. Its nearest allies are R. *setosum* and R. *Lapponicum*, from which latter it differs in its smaller stature and solitary sessile flowers.

It is now my purpose to enter into some details respecting the temperature and climate of the three zones of the Sikkim Himalaya, to which the Rhododendrons are chiefly confined. The information on this head is not so satisfactory as is desirable, owing to the want of a series of observations having been continued throughout the year anywhere, except at Darjiling itself, and there for but a few hours daily through one year. The mean annual temperature of that locality at 7000 feet may be considered as very nearly 53°, probably rather below than above it, this result being deduced from the daily maxima and minima, which, I think, gives too high a result, from local causes which I shall hereafter explain. The monthly means, on the other hand, vary much year by year, and with small differences of position, owing chiefly to the variable amount and unequal distribution of the rain-fall and cloud, and the great power of the sun's rays when unobstructed. The wonderful equality of temperature throughout the 24 hours from May till October is only disturbed by the sun's rays, which raise the thermometer 20° in a very few minutes, and sometimes for an equally short period of the whole day. During the height of the rains the mean temperature varies but a few tenths of a degree (June 61·2°, July 61·4°, August 61·7°), and there is no radiation by night of any consequence. Whilst, therefore, a short sunshine raises the thermometer for a few minutes 10° above the mean of the 24 hours, the minimum thermometer never falls more than 3° to 4° below the same mean, whence it follows that the mean of the whole day cannot be indicated by that of the maximum and minimum, as shown by a self-registering thermometer. Again, the maximum of heat occurs during the rains very generally before noon, often before 10 A.M., the forenoon being the least

cloudy part of the day, and the fogs that obstruct the sun's rays afterwards being both denser and of much greater perpendicular height than is supposed usual with this phenomenon. Cloudless afternoons are very rare in any month, and quite unknown during the warm ones, so that the mean yearly temperatures of 10 A.M. and 4 P.M. coincide within half a degree (10 A.M. 56·2°, 4 P.M. 56·7°), differing as much as 2° in the month of February only. In the cold weather, again, the maximum occurs in the afternoon. The mean temperature of the year coincides nearly with the 8 A.M. temperature, as far as I can ascertain.

My own observations were taken hourly at Darjiling, for, on the average, 18 hours of the day, during the rainy season of 1848, with many breaks however. From the end of October, 1848, to the latter part of January, 1849, I was travelling in East Nepal and in Sikkim between the elevations of 4000 and 17,000 feet. January, February, and April of 1849 I spent near Darjiling; March on the plains at the foot of the hills. From the beginning of May till Christmas, 1849, was wholly spent in travelling at all elevations above 4000 feet, but chiefly in regions above 6000 feet, and for several months between 12,000 and 14,000 feet; during September at 15,400 feet, and in October I spent a few days at 16,700 to 17,000 feet. The spring of 1850 (January to May) was passed in and about Darjiling. During all these excursions I made the study of climate second alone to botany. I recorded observations at certain hours, which were those adopted at the Calcutta Observatory (5° due south of Sikkim), and at many of which hours my friend, J. Muller, Esq., made comparative observations of pressure, temperature, and wet-bulb at Darjiling. My first proceeding, after halting or camping, was to hang the instruments in a very accessible place screened from radiation; and I endeavoured to observe hourly, when at liberty to do so; isolated observations in such circumstances being generally useless. I have taken the results of the comparison of a multitude of such observations, with coincident ones at Calcutta and Darjiling, as the basis of my calculations for the temperature, &c., of the zones above 7000 feet, checking them by various methods that suggested themselves. The computations in many cases are excessively complicated and laborious, but during my stay in Sikkim I was materially assisted in this, as well as in the preliminary calculation of several hundred altitudes by barometer, by Mr. Muller, the experienced accountant of the Calcutta Mint, to whose friendship I am very largely indebted, and but for whose generous aid and encouragement I should perhaps never have undertaken the distracting task of working out general results from the materials I accumulated. These broken series of comparative observations

have, if sufficiently numerous, a value when properly reduced, and are indispensable to the horticulturist; they give, within certain limits, the difference of temperature due to the difference of altitude for the month in which they are taken; and if a few days of several months, or a considerable portion of either equinoctial month (March or October), are spent at one place, the results give useful approximations to the mean annual temperature.

The results thus obtained have been checked by ground temperatures, taken by burying a brass tube 2 feet 6 inches to 3 feet in exposed soil, sinking in it, by a string or tied to a slip of wood, a thermometer whose bulb is well padded with wool. This, after a few hours, indicates the temperature of the soil, which has a definite relation to the mean temperature of the month, and further, has an obvious practieal application to the growth of plants. Such a tube and thermometer I usually caused to be sunk wherever I halted, if even for one night, except during the height of the rains, which are so heavy that they communicate to the earth a temperature sometimes above that of the air. I cannot too confidently recommend this simple plan to travellers, for the double purpose of getting an approximation to the mean monthly temperature by a few observations, and of finding that of the soil. One such observation is worth a hundred of such as are paraded in the works of travellers, as taken with a thermometer hung inside a tent, or to a tree, &c., the majority of which are not worth recording. With regard to other observations, the wet bulb and barometer were invariably registered with the temperature, and the minimum spirit thermometer set every night. Of maximum thermometers I tried many, but never kept one long in working order. A radiating thermometer in a parabolic reflector, and others placed on cotton and grass, were frequently exposed, and I found no material difference between that laid on cotton and that in the reflector. The black-bulb thermometer was often observed, and a large series of actinometer observations taken; these have not been computed, nor the dew-points from the wet-bulb temperatures, the correction (p-f′) always required at considerable elevations being laborious. I have, however, computed as many as to convince me that the cultivator may assume the mean state of humidity given for Darjiling, which I have computed (on monthly means of 1835 observations), as applicable to both the upper zones—the difference of humidity between 7000 and 14,000 feet being that the excessive rain-fall of the lower station, and great capacity for moisture of the lower warmer strata, do not extend proportionally to the upper, whose cooler atmosphere, however, holds less vapour in suspension. In all three zones the atmosphere is generally well loaded with humidity.

Distribution of Temperature in the Three Zones.—A remarkable uniformity prevails throughout the year at the lower zone, there being, at 7000 feet, but 22° difference between the mean temperatures of the hottest and coldest months; whilst in London, with a lower mean temperature, the equivalent difference is 27°. In the second (middle zone) at 11,000 feet this difference is equal to that of London. In the upper it is still greater, the climate becoming excessive at 15,000 feet, where the difference amounts to 30° at least.

Between 6000 and 10,000 feet, *i. e.* throughout the first zone, I find the mean annual temperature decreasing with the elevation at the rate of 1° to every 320 feet.

Between 10,000 and 14,000 feet at 1° to every 350 feet.

And between 14,000 and 18,000 feet at 1° to every 400 feet.

This gives—

Altitude.	Mean Shade.	Mean Warmest Month.	Mean Coldest Month.	Mean Daily Range of Temperature.	Rainfall, in inches.	
11,000 feet .	40·9	50·0	24·0	20·0	40·0	1° = 320 feet.
15,000 feet .	29·8	40·0	11·0	27·0	20·0	1° = 350 feet.
19,000 feet .	19·8	32·0	0·0	35·0	10·0	1° = 400 feet.

15,000 feet being the limit of perpetual snow where that phenomenon advances farther south in Sikkim, and 19,000 feet the limit of perpetual snow in Tibet. Supposing the same law to apply (which I exceedingly doubt) to heights above 19,000 feet, 2° would be the mean annual temperature of the summit of Kinchinjunga, altitude 28,178 feet, the loftiest known spot on the globe.

The upper limit of phenogamic vegetation coincides with a mean temperature of 30° on the south flank of Kinchinjunga, and of 22° in Tibet; in both cases animals and perennial-rooted herbaceous plants are to be found at elevations corresponding to these mean temperatures, and even at higher elevations in sheltered localities. I have assumed the decrease of temperature for a corresponding amount of elevation to be gradually less in ascending (1° = 320 feet at 6000 to 10,000 feet, and 1° = 400 feet at 14,000 to 18,000 feet). My observations appear to prove this, but I do not regard them as conclusive; supposing them to

be so, I attribute it to a combination of various causes, especially to the increased elevation and yet unsnowed condition of the mass of land elevated above 16,000 feet, as is shown in the woodcut (p. 85); also to the greater amount of sunshine there, and to the lesser density and height of the fogs which obstruct the sun's rays at all elevations. In corroboration of this I may mention that the difference of temperature is much less in summer than in winter, 1° of Fahr. being equivalent to only 250 feet in January between 7000 and 13,000 feet, and to upwards of 400 feet in July. Again, at Darjiling (7500 feet) the temperature hardly ever rises above 70° in the summer months, yet it often rises even higher in Tibet at 12,000 to 14,000 feet. On the other hand, the winters, and winter nights especially, are disproportionately cold, the thermometer falling upwards of 40° below the Darjiling temperature at 6000 feet above that elevation.

The diurnal distribution of temperature is equally and similarly affected by the presence of vapour in the three different zones. The lower zone is first clouded, because the lower ranges, of 6000 to 10,000 feet, first receive the diurnal charge of vapour-loaded southerly winds; the middle gets more of the sun's rays, and the upper more still. Though the summer days of the upper zone are warmer than their elevation would indicate, the nights are not proportionally colder; for the light mist of 14,000 feet, which replaces the dense fog of 7000 feet, effectually obstructs nocturnal radiation, though it is less an obstacle to solar radiation. Clear nights, be it observed, are as rare at 14,000 as at 7000 feet, the nights being rainy, if windy; or, if calm, cold currents descend from the mountains, condensing the moist vapours of the valleys, whose narrow floors are at sunrise bathed in mist at all elevations in Sikkim. The rise and dispersion of these dense masses, and their collection and recondensation on the mountains in the morning, is one of the most magnificent phenomena of the Himalaya, when viewed from a proper elevation; it commences as soon as the sun appears on the horizon.

The mean daily range of the thermometer at 7000 feet is 13° in cleared spots, but considerably less in wooded, and certainly one-third less in the forest itself. At 11,000 feet it amounts to about 20°, and at 15,000 feet to 27° (London 17·5°). These values vary widely in the different months, being much less in the summer or rainy months.

At 7,000 feet	it amounts to	8°–9°	in Aug.	and Sept.,	and 17°	in Dec.
11,000	,,	12°	,,	,,	30	,,
15,000	,,	15	,,	,,	40	,,
London	,,	20	,,	,,	10	,,

Temperature of the earth.—This, at 2½ to 3 feet depth, varies with the temperature of the month, but is hardly affected by the diurnal variation, except in extreme cases. In summer, throughout the rains, May to October, the temperature is that of the month, which is imparted by the rain to the depth of 11 feet during severe continued falls (of 6 to 12 inches a day), on which occasions I have seen the buried thermometer indicating a temperature above the mean of the month. Again, in the winter months, December and January, it stands 5° above the monthly mean; in November and February 4° to 5°; in March it is a little below the mean temperature of the month, and in October above it; April and May being sunny, it stands above their mean temperature; June to September a little below the mean temperature of each respectively.

In the middle and upper zones the sunk thermometer always stands considerably above the mean of the month, the sun's rays being more powerful and frequently felt, the rain less; and the earth, being cooled less by nocturnal radiation than it is warmed by solar, accumulates heat to a certain depth. Thus in January, at 13,000 feet, I have found it 17° above the mean temperature, though the soil was frozen hard for 16 inches; and in July, at the same elevation, 7·5° above the mean temperature. In August I have seen it + 8° at 12,000 feet, in September + 7·4° at 15,400 feet, and in October + 12° at 16,800 feet; in July +7·6° at 12,800 feet, and in October + 10·5° at the same spot; in December + 9° at 13,500 feet with several inches of frozen soil. It is probable that the intense winter cold of the upper zone does not materially affect the soil at 3 feet depth, for there is always a sufficiently deep covering of snow after the second week of January to protect the soil from excessive cold.

Solar radiation.—From a multitude of desultory observations with the black bulb thermometer, I conclude that at 7000 feet, 67° above the temperature of the air is the average maximum effect of the sun's rays on a black bulb thermometer* throughout the year, amounting rarely to + 70° and + 80° in the summer months, and more frequently in the winter. These results, though greatly above what are obtained at Calcutta, are not much, if at all, above what prevail at the foot of the hills and up the Gangetic valley. This effect is greatly increased with the elevation. At 10,000 feet, in December, at 9 A.M., I saw it mount to 132° with a diff. of +94°, whilst the temperature of shaded snow hard by was 22°; at 13,100 feet, in

* From the mean of very many observations I find that 10° is the average difference between two otherwise equal and similar white and black bulb thermometers at the level of the sea.

January, at 9 A.M., it has stood at 98°, diff. + 68·2°, and at 10 A.M. at 114°, diff. + 81·4°, whilst the radiating thermometer on the snow had fallen at sunrise to 0·7°. In December, at 13,500 feet, I have seen it 110°, diff. + 84°; at 11 A.M., 11,500 feet, 122°, diff. + 75°. In November, 9 A.M., at 13,500 feet, 112°, diff. + 82°. This is but a small selection from many, of the extraordinary power of solar radiation in the coldest months at great elevations. It is accompanied by a great increase of solar light, as I found by means of the black glass photometer.

Two phenomena particularly obstruct the solar light and heat —the clouds and fog from the end of May till October, and the haze from February to May. On the former I have dwelt sufficiently at length. Two months alone are usually clear, one before and one after the rains, when the air, though still humid, is transparent. The haze has never been fully explained, though a well-known phenomenon. On the plains of India, at the foot of the hills, it begins generally in the forenoon of the cold season, with the rise of the west wind, and, in February especially, obscures the sun's disc by noon; frequently it lasts throughout the 24 hours, and is usually accompanied by great dryness of the atmosphere. It gradually diminishes in ascending; it cannot be said to prevail at 7000 feet, and I have never experienced it at 10,000. At 7000, however, it very often, in April, obscures the snowy ranges 30 miles off, which are bright and defined at sunrise, and either pale away or become of a lurid yellow-red, according to the density of this haze, as they disappear at 10 A.M. I believe it always accompanies a S.W. wind and dry atmosphere in Sikkim.

Nocturnal radiation.—This is even a more difficult phenomenon for the traveller to estimate than solar radiation, the danger of exposing instruments at night being always great in wild countries. I have used the parabolic reflector and white cotton most frequently, and find no material difference in the means of many observations of each, though often 1° to 2° in individual ones. Avoiding radiation from surrounding objects is very difficult, especially in wooded countries. I have also tried the radiating power of grass and the earth; the latter generally is lower, the former higher than the thermometer exposed on cotton or in the reflector, but much depends on the surface of the herbage and soil. Snow radiates the most powerfully of any substance I have tried; in one instance, at 13,000 feet, in January, the thermometer on snow fell to 0·2°, which was 10·8° below the temperature at the time, grass showing 6·7°, and on another occasion to 1·2°, when the air at the time (before sunrise) was 21·2°, and the difference 20°. I have frequently made this observation, and always with a similar result; it may

account for the great injury plants sustain from a thin covering of ice on their foliage, even when the temperature is but little below the freezing point.

The power of terrestrial radiation increases with the elevation, as does solar radiation, but not in an equal proportion. At 7000 feet there is little radiation during the rains; the nights are almost invariably cloudy—3° to 4° is the mean maximum, but it is not on one night out of six that there is any radiation. From October to December the amount is greater = 10° to 12°, and from January till May greater still, reaching 15°. During the winter months the effect of radiation is often felt throughout the clear days, dew forming abundantly at 4000 to 8000 feet in the shaded bottoms of narrow valleys, into which the sun does not penetrate till 10 A.M., and from which it disappears at 3 P.M. I have seen the thermometer in the reflector fall 12° at 10 A.M. in a shaded valley. This often produces an anomalous effect, causing the temperature in the shade to fall after sunrise; for the mists which condense in the bottoms of the valleys after midnight disperse after sunrise, but long before the sun reaches the valleys, and powerful radiation ensues, lowering the surrounding temperature. A fall of 1° to 2° after sunrise of air in the shade is hence common in valleys in November and December. The excessive radiation of the winter months often gives rise to a curious phenomenon; it causes the formation of copious dew on the blanket of the traveller's bed, which radiates to the tent roof, and this inside an open or closed tent. I have experienced this at various elevations, from 6000 to 16,000 feet. Whether the minimum temperature was as high as 50° or but little above zero, the effect is the same, except that hoar frost or ice forms in the latter case. Another remarkable effect of nocturnal radiation is the curl of the alpine Rhododendron leaves in November, which is probably due to the freezing and consequent expansion of the water in the upper strata of cells exposed to the sky. The first curl is generally repaired by the ensuing day's sun, but after two or three nights the leaves become permanently curled, and remain so till they fall in the following spring.

Many alpine plants resist a great degree of radiation; the *Cyananthus*, especially, I have observed to be uninjured by a minimum temperature of 31·0° lowered 12·0° by radiation, in the month of September, at 15,500 feet; and yet this is one of the most delicate as well as beautiful of Himalayan blossoms. As a general rule, however, the commencement of the September and October radiation is the signal for the extinction of the alpine herbaceous vegetation.

I have elsewhere said that the nocturnal radiation of the

English spring months is the great obstacle to the cultivation of many Himalayan plants; it is not hence to be inferred that there is no similar amount of radiation in the Himalaya, for, on the contrary, in April its amount is much greater than in England, equalling 13° of difference frequently, and I have seen 16° at 7500 feet; but the minimum temperature at the time is 51°, and the absolute amount of cold hence immaterial. The mean minimum of London is 38·0°, and when lowered 5·5° by radiation the consequent cold is very considerable. Mr. Daniell, in his admirable essay on the climate of London (the perusal of which first gave me an interest in these pursuits), mentions +17° as the maximum effect of nocturnal radiation ever observed by him; I have had +20° from the surface of snow, and I have registered + 13·0°, + 14·0°, + 15·5°, and + 16·0° in April at Darjiling; nearly as much at 6000 feet in February; once +12·0°, twice +13·0°, and once +14·2° in September at 15,500 feet; +10° in October at 16,800 feet; +11·0°, + 12·0°, and nearly + 13·0° in January at 7000 feet; + 10° to + 14·5° repeatedly in February at that elevation, and + 12° to + 14·7° at 10,000 feet in November on several occasions.

To conclude, though nocturnal radiation does occur frequently, and has on the whole a much more powerful effect in Sikkim than in England, I doubt if the mean effect of all the months in Sikkim would equal that of London, from so many more nights being cloudy, which cloudy atmosphere and the comparatively high temperature of the nocturnal radiating months are what a Himalayan vegetation wants in England.

Winds.—Of the Himalayan winds there is little to be said affecting the horticulturist. The southerly moist, warm current is perennial, except during the spring months, when occasional S.W. squalls or moderate day winds blow. The nights are usually calm, or return cool winds sweep gently down the valleys. The northerly winds are said to bring snow; in December to February they appear to me to be local phenomena, and are under currents from the snowed regions, which condense and freeze the lower strata of the main current. Heavy gales occur at the equinoxes in the Himalaya as all the world over, but I have never experienced cyclones or hurricanes. Midsummer and midwinter are also generally characterised by storm and rain.

Atmospheric pressure.—It has long been surmised that an alpine vegetation may owe some of its peculiarities to the diminished atmospheric pressure; and that the latter being a condition which the gardener cannot supply, he can never successfully cultivate alpine plants in general. I know of no foundation for this hypothesis; many plants, natives of the level of the sea

in other parts of the world, and some even of the hot plains of Bengal, ascend to 12,000 and even 15,000 feet on the Himalaya, unaffected by diminished pressure. Any quantity of species from low countries may be cultivated, and some have been for ages, at 10,000 to 14,000 feet, without change. It is the same with man and the lower animals; innumerable instances may with ease be adduced of pressure alone inducing no appreciable change, whilst there is an absence of any proof to the contrary. The phenomena that accompany diminished pressure are the real obstacles to the cultivation of alpine plants, of which cold and the excessive climate are perhaps the most formidable. Plants that grow in localities marked by sudden extremes of heat and cold are always very variable in stature, habit, and foliage. In a state of nature we say the plants "accommodate themselves" to these changes, and so they do within certain limits; but for one that survives of all the seeds that germinate in these inhospitable localities, thousands die. In our gardens we can neither imitate the conditions of an alpine climate, nor offer others suited to the plants of such climates.

Light.—The plants of the different zones are very differently situated with regard to this element. The forest region, which so uniformly extends to 12,000 feet, shuts out much light from the plants that grow in it, and such are generally pale-coloured or white,—as, amongst rhododendrons, R. *Hodgsoni*, R. *cameliæflorum*, R. *argenteum*, R. *Falconeri*, &c. &c. On the other hand, many of the most gorgeously coloured ones abound in the sunniest and lightest spots, as R. *fulgens*, R. *arboreum*, R. *Thomsoni*. Still it must be recollected that many species eminently abundant in the sunniest exposures are pale flowered, as R. *Wightii*, R. *campylocarpum*, R. *lilacinum*, and R. *Griffithii*; and that some gorgeous species are very frequent in deep woods, as R. *arboreum* itself, R. *Thomsoni*, R. *barbatum*, R. *cinnabarinum*, and that their colour is not materially lessened, except the shade be unnaturally deep. It is hence difficult to appreciate the direct influence of sunlight on the individual plants in the Himalaya. If on the other hand we compare all the species as there existing, with their congeners in higher latitudes, it becomes evident that the balance in favour of gorgeous colouring is greatly on the side of the Himalaya; which renders it probable that the more direct sun's beam of lat. 26° to 28° has an influence which its slanting rays in high latitudes have not. This is a very interesting subject for future investigation; it cannot be satisfactorily dealt with, except by accurately estimating the number of coloured species in two well-marked localities. One remarkable fact has already come prominently before me, which is, that the R. *ciliatum*, now flowering abundantly at Kew, has larger

blossoms than I ever saw it to have in the Himalaya, but of a paler hue by far than any of the red-coloured series in Sikkim, except R. *anthopogon*,—judging from colour alone, I should not have recognised it. May is its flowering season in its native locality, and a purplish red the colour I have been accustomed to see it.

Sikkim climate as compared with London.—The colder winters and warmer summers are the prominent differences of the London climate, as the following comparison shows:—

	Mean Temp.	July.	January.	Range.	Mean Max.
London	50·0	63·2	36·0	27·2	71·0
Darjiling	53·5	61·4	40·0	21·4	65·3

	Mean Min.	Extreme Max.	Extreme Min.	Extreme Diff.
London	34·2	94·0	–4·5	98·5
Darjiling	38·2	71·0	25·5	46·5

The extreme Darjiling data given here are not low enough for the minimum, or high enough for the maximum; but they give a sufficient approximation. At 10,000 to 11,000 feet, where most species of rhododendrons grow, the climate in its main features of great extremes approaches nearer to the English; but the mean temperature (40°) is too low. Our summers are much too hot for the plants of that elevation, and our winters being too mild, they make shoots earlier in spring than in the Himalaya, which are cut off by frosts in April. Though the temperature is more uniform in Sikkim, it presents one curious anomaly, which is, that an accession of 8° of temperature occurs in March, above February, the parallel of which does not occur till June in England, which is 8° warmer than May. This brings the rhododendrons so early into flower at 7000 feet, and keeps the radiating thermometer always above freezing for the rest of the spring.

Again, there is in London nearly 20° of average difference between the day and night temp. of April, and 22° in May,—months wherein 15° and 13° are the corresponding Darjiling differences. This is a very powerful obstacle to the cultivation out of doors of many otherwise very hardy Himalayan plants, which are impatient of sudden changes, and incapable of bearing sudden, sharp frosts in March and April.

As the flowering season advances and fruit-setting comes on, the temperature in Sikkim becomes more markedly uniform, the mean difference between day and night being, in May, 13°; June, 11°; July, 10°. In London it is not so: May, 22°; June, 21·6°; July, 21·6°. Turning again to the autumn solstice, the sudden fall of temperature occurs both in Sikkim and London in November, and amounts in each to upwards of 7°; but whereas the difference between day and night is increasing in Sikkim, it decreases in London, a circumstance which may affect the ripening of seed, by checking the vegetative organs.

I have here taken the Darjiling elevation of 7000 feet as the standard of comparison between the Himalaya and London, and of course it is understood that I here speak of the cultivation of species of that zone; but as most of the Himalayan plants have a range of fully 3000 feet, which equals a mean annual difference of temp. of about 10°, it follows that localities with a mean annual temp. of 46° to 56° are in that one respect suited to the cultivation of species of the lower zone. It must also be borne in mind, that the temperatures are less uniform above 7000 feet in Sikkim, than at that particular elevation where the maximum of moisture prevails.

Seasons, general remarks on.—These, throughout the Himalaya, partake more or less markedly of the hot and cold, or wet and dry of the plains of Bengal, with this exception, that the dry westerly wind which sweeps across the plains during many of the winter months is scarcely felt in Sikkim, or in the afternoon only in occasional puffs from the S.W. The southerly wind blows steadily from May till November, but is not uniformly moist at all seasons; it attains its maximum of humidity in July and August, when, being warmest, its capacity for transporting moisture is also greatest. From November till April, calms and light winds prevail, with occasional gales. Electric disturbances are most frequent from March to May, and again at the end of the rains; they are however almost wholly confined to the foot of the hills and outer ranges.

The rainy season commences with a spring fall in April or May, which is the flowering seasons of all the rhododendrons, and of most of the magnolias of the lower zone (7000 to 10,000 feet). A remarkable uniformity of humidity and temperature now prevails at all elevations, till the fruiting season, which occurs in September at the upper zone, in October in the middle, and November and December in the lower zone. The rains have fairly "set in" by the middle or end of May, and the rhododendron flowers are withered within a month of their flowering, that is, by the beginning of June in both lower and middle zone, and but little later above 14,000 feet; for though they bud so late in the alpine regions, vegetation proceeds there much more rapidly.

In the upper zone May is the budding month, and the resinous scales that envelop the rhododendron flowers are no sooner thrown off than the leaves are expanded, and the flowers follow with that rapidity which is so characteristic of an arctic spring, and indeed of all excessive climates.

The distribution of the seasons in the three zones is very peculiar, and gives rise to some anomalies that have puzzled naturalists. From the middle of October to that of May, vegetation

is torpid above 14,000 feet, and indeed almost uniformly covered with snow. From November till the middle of April, vegetation is also torpid in the middle zone (above 10,000 feet), except that a few trees and bushes do not ripen all their seeds till December. The three winter months (December, January, and February) are all but dead in the lower zone (above 6000 feet), the earliest appearance of spring at Darjiling (7000 feet) being at the sudden accession of heat in March. From May till August the vegetation in each zone is (in ascending order) a month behind that below it; 4000 feet being about equal to a month of summer weather in one sense. I mean by this, that the genera and natural orders which flower at, say 8000 feet in May, are not so forward at 12,000 feet till June, nor at 16,000 feet till July. After August, however, the reverse holds good; then the vegetation is as forward at 16,000 feet as at 8000 feet. By the end of September most of the natural orders and genera have ripened their fruit in the upper zone, though they have flowered as late as July; whereas October is the fruiting month at 12,000, and November below 10,000 feet.

The Rhododendrons offer good instances of this :—

16,000 to 17,000 feet, R. *nivale* flowers July; fruits September.
13,000 to 14,000 feet, R. *anthopogon* flowers June; fruits October.
11,000 to 12,000 feet, R. *campanulatum* flowers in May; fruits in Nov.
8,000 to 9,000 feet, R. *argenteum* flowers in April; fruits in December.

And so it is with many species of *Compositæ* and *Umbelliferæ*, and indeed of all natural orders, some of which I have on the same day gathered in ripe fruit at 13,000 to 14,000 feet, and found still in flower at 9000 to 10,000. The brighter skies and more powerful and frequent solar radiation at the greater elevations, account for this apparent inversion of the order of nature.

I shall conclude this long essay with some notices of the vegetation of the months in the three zones specified, assuming the elevations of 7000 feet, 11,000 feet, and 15,000 feet, as typical of the three. I shall commence with March, which begins the new year as far as vegetation is concerned at 7000 feet.

March.—In the lower zone, in which alone vegetation is active, the mean temperature is 50·7°, or 3° below the mean of the year, and 8° to 9° warmer than February. The mean maximum is 58·4°; 68° is the extreme temperature attained in the shade, and 120° in the sun, from my very insufficient data for solar radiation in this month. The mean minimum is 43°; the greatest cold 37°; and when aided by radiation 27·8°; with a maximum difference of 9° between the minimum thermometer

and radiating one. The mean daily range is 15° to 16°, and the thermometer at 3 feet depth stands at 50°. The dew-point is 45·8° ; the mean humidity 0·8° to 0·9°, and the rain-fall about an inch, which generally comes in heavy showers of rain and hail, sometimes of sleet at the equinoxes.

This is eminently the spring month at Darjiling. Laurels and maples bud and leaf, together with many other trees, but not oaks. The ground is often covered with the long leaf bracts of the *Tetrantheras*. The large white *Michelia* flowers, Cherry abundantly, white *Rhododendron* (*argenteum*) and the scarlet (*arboreum*) in sunny spots. An early leafless *Cœlogyne* is common on the rocks (*C. præcox?*), the small blue gentian covers the ground on grassy banks, with the yellow *Fragaria Indica*, *Tormentilla*, a few violets, a pretty blue *Mazus*, and some few *Rubi*. The *Michelia*, cherry, and rhododendrons are, however, the only conspicuous plants of this season and elevation, with a pretty *Disporum* in the woods. In the garden peaches are in full flower, and many plants of the cold season of India, such annuals especially as belong to too cold or dry a climate to survive the damp heat of May and June if sown then—stocks, for instance. Most other garden flower seeds and bulbs are planted now, as well as vegetables ; the young plants sown previously require transplanting and protection from the hail, which occasionally cuts up tender plants terribly. Potatoes are planted out. Table vegetables are still abundant of the ordinary kinds. Insects commence their attacks on the gardens.*

April.—Mean temperature 56° ; of maxima 64°, and minima 48° ; extremes 68° and 38°. Extremes of radiation—solar 125°, terrestrial 33°. Extreme differences—solar 66°, terrestrial 16°. The mean daily range is nearly 16° ; sunk thermometer 60° ; dew-point 50° ; and saturation 0·80°. Rain 2·5 inches.

Most of the trees leaf and many flower in this month, as laurels, oaks, chesnuts, *Hydrangea*, birch. The smaller blossomed *Michelia* and the large magnolias flower in profusion, and the woods at 8000 to 9000 feet in some years look mottled with their great white and red flowers. Maple leaves are broad and red. Birch hangs its catkins. Some pretty and conspicuous shrubs flower, as *Adamia cyanea*, a *Viburnum*, white honeysuckle, the beautiful purple *Stauntonia*, several white and pink *Rubi*, a very sweet *Daphne* in the woods (of which paper is made), and the curious genus *Helwingia*. On the ground *Arisæmas* appear in profusion, and many other herbaceous plants leaf, as *Aralia*, *Paris*, and *Polygona*. Yellow strawberry,

* I am indebted to my friend Dr. Campbell, the superintendent of Darjiling, for most of the garden memoranda of the month.

Tormentilla, violets, and the ground-raspberry are common, with several *Dispora*, *Ophiopogon*, *Melissa parvifolia*, and *Isopyrum*; beautiful white-flowered leafy *Cœlogynes* adorn the moist rocks, which, with a very fine *Cymbidium* on the trees, are common at and above 6000 feet.

Little is doing in the garden more than was in March; sowing and planting out go on with activity. English strawberries flower abundantly, as do currants.

May.—Mean temperature 56·6° (only 1° above April). Means of maxima 65·3°, and of minima 50°; extremes 69° and 38°. Extremes of radiation—solar 125°, terrestrial 40°. Mean daily range 13·3°; dew-point 50°; saturation 0·91°. Rain 9 inches, falling in sharp showers late in the forenoon or afternoon of about half the days in the month. More falls in the night than in the day.

The botanist may reap a rich harvest in this month, the jungle and mountain plants between 6000 and 10,000 feet coming into flower in rapid succession. Of these the trees are—

Yew (probably identical with English).	*Symplocos.*	Walnut.
Maples, various.	Alder.	*Euonymus.*
Apple and several *Pyri.*	Large-leaved oak.	*Myrsineæ*, various.
Photinia.	*Hydrangea.*	*Olea.*
Manglietia.	*Sauraujа.*	*Podalyria.*
Lauri, various.	*Englehardtia.*	Ash.

The great magnolias and michelias, and large white Rhododendron (*argenteum*), are all past flower.

Of shrubs there are many and beautiful species—

		Woody climbers.
Limonia.	*Rubi*, several (the yellow-fruited now abundantly ripe).	*Stauntonia.*
Stauntonia.	*Indigofera.*	*Saurauja.*
White Rose (*Webbiana*).	*Cotoneaster.*	*Kadsura.*
Sarcococca.	*Adamia.*	*Sphæros temma.*
Aucuba.	*Smilax.*	*Sabia.*
Symplocos.	*Ribes.*	*Myrsineæ sp.*
Gualtheriæ.		*Holostemma.*
Vaccinia.		*Smilax.*
Rhododendrons.		*Jasminum* (white).

Herbaceous plants are common, but being annuals they are comparatively backward; the chief are—

Dentaria.	*Androsace.*	Many and splendid *Arisæmas.*
Viola.	*Tiarella.*	*Panax* (2 herbaceous sp.).
Anemone.	*Chrysosplenium.*	Some fine *Hedychia.*
Potentilla.	*Ophiopogon.*	*Roscoea.*
Fagopyrum.	*Coriaria.*	*Streptolirion.*
Paris.	*Fumaria.*	
Trillium.	*Dielytra.*	
Euphorbia.	*Corydalis.*	

A leafless purple *Cœlogyne* (*C. Wallichii?*) is abundant, and makes a gorgeous show on the trees, as do the white-flowered leafy species.

The gardens at Darjiling are very gay during this month—roses, poppies, snapdragons, heartseases, larkspurs, pinks, and lupines. Strawberries ripen, and continue in fruit for two months. The cucurbitaceous vegetables are planted, as melons, cucumbers, squash, &c. Those planted in autumn are now producing abundantly, as peas, French beans, salads, turnips, and cabbages.

Middle Zone.—In this region spring is only now established; much less rain (one-third less) falls above 10,000 feet, in the position marked P in the woodcut, than at Darjiling. Snow occasionally sprinkles the forest, but what falls does not lie on the ground. On the other hand, the winter's snow, still abundant at 12,000 feet, is rapidly melting, and the rivers rise daily. The different pines, *Abies Webbiana*, *Brunoniana*, and the larch flower, as do *Viburnum*, willow, and juniper. Very few herbaceous plants are advanced, of which the chief are a purple *Dentaria*, and some other *Cruciferæ*, primroses, *Anemone*, *Ranunculi*, a *Gentiana*, two large *Arisæmas*, a purple *Saxifraga* like *ciliata*, *Cotoneaster*, *Potentilla*, and *Podophyllum*.

Upper Zone.—So little snow falls here, comparatively speaking, that the passes even of 18,000 to 19,000 feet are open this month, but vegetation has made little progress, the soil being frozen in many places. Even the grass is not long enough to be cropped by cattle or sheep.

June.—Mean temperature (7000 ft.) 61·2°; of maxima 66·7°, and minima 55·8°. Extremes 71° and 51·5°. Extremes of radiation—solar 126°, terrestrial 47°. Extreme differences—solar 62°, terrestrial 4·8°. Mean daily range of temperature, 11°. Mean dew-point, 59·5°; saturation 0·93°. Rain 26·964 inches (mean of 5 years—maximum 32·68 inches, minimum 12 inches), distributed, in 1849 (when 32·688 inches fell), over every day but 7, and every night but 3. Between sunrise and sunset 12·593 inches fell; during the night 20·035 inches. The showers, though heavy and frequent, do not combine to form a continuous downpour at any time, and there is a good deal of sunshine from 8 to 10 A.M., and often at sunset also.

The flowering season of most of the trees at 7000 feet is now over, but many shrubs blossom, as *Polygala*, *Xanthoxylon*, *Indigofera*, a *Magnolia* with white sweet-scented globe flowers, *Spiræas*, *Hydrangea*, yellow jasmine, various *Araliaceæ*, *Neillia*, *Leycesteria*, and shrubby *Polygona*; *Pyri*, many and shrubby; *Rosaceæ* generally; some laurels and *Viburna*, vines. Of herbs, balsams now appear prominently, with *Streptolirion*, *Ge-*

rania, great-flowered *Aristolochia*, *Parochætus*, *Smilacina*, *Convallaria*, and *Dispora*; some fine *Scitamineæ*, *Parnassia*, *Potentilla anserina*, *Arum* and *Arisæmas*, *Monotropa*, *Pyrola*, *Pieris*, yellow *Crawfurdia*, *Iris*, *Campanula*, *Balanophora*, *Habenariæ*, and some curious terrestrial orchideæ, as *Cyrtosia*. Wild brambles are abundant, and several kinds are very good. *Elæagnus* berries ripen.

In the gardens the rains damage the unprotected flowers sadly. Cuttings are taken of rose, sweet-william, and pink. Such flowers as will blossom after the rains are now sown, as sweet-peas and lupines. Tulips flower, but not very well, as does the *Fuchsia*. Transplanting goes on actively. Table vegetables of all kinds are abundant and good, but flavourless.

Middle Zone.—I spent the greater part of this month above 11,000 feet, a little to the north of the position of Kinchinjunga, in well-wooded valleys, &c. The weather was uniformly cloudy, misty, and rainy; but the showers were never excessive, and only 6 inches fell, or one-half less than at Darjiling. The trees in flower are generally of the same genera as flowered at 9000 to 10,000 feet last month, and the species are in many instances the same, as *Pyri*, birch, one oak, willow, a maple, holly (forming a bush); *Abies Webbiana* cones are a splendid purple, those of the larch red brown, and of *P. Smithiana* green; junipers form berries. A white cherry, Loniceras, *Symplocos*, and *Pieris*, are the chief flowering trees. Of shrubs there are other Loniceras, Potentillas, Rhododendrons, *Araliaceæ*, 2 currants, willows, *Andromeda*, *Gualtheria*. Primroses are the glories of the herbaceous vegetation, appearing in profusion, yellow, white, and purple; beautiful anemones and ranunculi flower, with *Thalictra*, some *Berberris*, a splendid single-flowered *Mecnopsis*, several *Cruciferæ*, *Tamarix* (creeping), *Sibbaldiæ*, *Fritillaria*, *Orobanche*, small *Paris* and *Trillium*, *Pinguicula*, *Parnassia*, *Allium*, *Morina*, *Ophiopogon*, the great *Rheum*, *Juncus*, and *Luzula*. Rhododendrons many.

Upper Zone.—Towards the end of this month the grass is well grown in the valleys, at 13,000 to 16,000 feet, and the cattle are driven up to the grazing grounds. A few plants flower above 15,000 feet, as *Anemone*, *Primula*, *Astragalus*, *Parnassia*, and *Picrorhiga teeta*.

July.—Mean temperature 61·4°; of maxima and minima 65·5°—57·3°; extremes 70°—56°. Extremes of radiation, solar 130°, terrest. 3·52°. Extreme differences, solar 62°, terrest. 3·5°. Mean daily range of temperature 8°. Dew-point 60·7°. Saturation 0·97°. Rain-fall 25·336 inches (mean of 5 years, maximum 33, minimum 17·915). In 1848, 21·605 inches fell; it rained every day but one, 12·22 inches per day, and 9·235 between

sunset and sunrise, there having been 18 rainless nights, but only five occasions on which none fell between sunrise and sunset.

The beautiful scarlet *Buddleia* at 9000 to 10,000 feet, and a fine *Erythria* at 6000 to 7000 feet, are the only remarkable trees I have noted as flowering during this month in the lower zone, except a *Saurauja*. Of shrubs, the chief are *Hyperica Deutzia*, *Philadelphus*, *Neillia*, and many that flowered late in the previous month, together with the beautiful red rose. Herbaceous plants succeed one another rapidly; magnificent Balsams, *Cyrtandraceæ*, Begonias, *Scitamineæ*, and *Æschynanthus* abound, with *Mimulus*, *Torrenia*, *Campanula*, *Codonopsis*, *Thalictra*. The gigantic lily, and various terrestrial *Orchideæ*, as *Calanthe*, *Habenaria*, *Spathoglottis*, *Neottia*, and *Serapias*. *Epilobia* are common. *Circeæ*, *Valeriana*, *Notochæte*, the purple *Convolvulus*, white-flowered *Polygona*, and *Cucurbitaceæ* begin to flower. Acorns, holly, and laurel berries are fully formed; *Labiatæ* bud, as do *Compositæ* and *Urticeæ*.

In the garden there are still heartseases, lupines, sweet peas, roses, evening primroses, dahlias, sweet Williams, hollyhocks, mallows, snap-dragons, and marigolds. The kitchen-garden shows radishes, cress, cabbages, squash, and other Cucurbitaceæ; French beans and peas, but sparingly; cabbages, brocoli, and cauliflower abundant. Weeds grow apace and keep the gardener busy.

Second, or Middle Zone.—I spent much of this month at 12,000 to 16,000 feet elevation, and further north than in June. The rain-fall I found reduced to little more than 6 inches; it rained however nearly every day, three times as much falling at night as during the day. Between 10,000 and 14,000 feet vegetation has advanced during this month with marvellous rapidity. The short grass and herbage of open spots, especially at 10,000 to 12,000 feet, are replaced by a rank growth, 6 to 8 feet high, of *Thalictra*, tall *Astragalus*, grasses, and *Cyperaceæ*, *Euphorbiæ*, a superb yellow and a purple *Meconopsis*, each with racemes 1 to 2 feet long of blossoms as broad as the palm of the hand; gigantic *Heraclea* spring up 9 feet high whilst fruiting, with twiggy *Bupleura*, *Dipsacus*, *Convallariæ*, *Dispora*, and *Smilacina*, *Cimicifuga*, *Rumex*, and various Compositæ not yet in flower, bound together by masses of *Cuscuta* and *Codonopsis*. Amongst these grow, but more sparingly, *Balanophora*, *Morina*, *Gerania*, large *Cynoglossa*, many *Pedicularis*, *Hypericum*, and *Gamoplexis*, together forming complete thickets of herbage. In more open places, at greater elevations, 12,000 to 13,000 feet, *Cypripedium*, *Epipactis*, and small *Orchideæ* are very abundant, with tufted *Astragali*, *Lloydia* (two species),

other *Pediculares*, *Triglochin*, *Callitriche*, *Veronica*, *Campanula*, *Saxifraga*, *Draba*, small *Morina*, *Parnassia*, *Rheum*, *Thermopsis*, a *Saussurea* with bladdery bracts, *Anisodinus* flowers, Berberry begins to fruit, as do *Pyri* and *Lonicera*. Agriculture is little pursued at this elevation, *Fagopyrum* crops flower at 12,000 feet, and barley sown two months before is fully in ear, or, if sown in the end of May, in flower early this month. Radishes and turnips are in leaf at 15,000 to 16,000 feet, and their tubers formed. Potatoes flower.

Third, or Upper Zone.—There is much snow still in July, even on the rearward mountains, where the perpetual snow-line is at 18,000 feet; still most of the shrubs that are found above 14,000 feet are in flower, as *Spiræa*, *Lonicera*, *Potentilla*, willow, juniper, berberry, and an occasional rose. *Ranunculaceæ* abound, *Ranunculus*, *Delphinum*, *Aconitum*, *Caltha*, many *Astragali* flower, with *Corydalis*, *Hypecoum*, *Myosotis*, *Parnassia;* many *Pedicularis*, *Sibbaldia;* small *Primulæ*, *Alsineæ*, and *Cruciferæ;* the alpine purple *Meconopsis*, *Morina*, *Androsaces*, *Picrorhiza*, *Nardostachys*, *Gymnandra*, *Dracocephalum*, *Veronica*, *Seda*, *Cassiope*, and *Menziesia*. The single-spiked *Carices* and *Poæ* flower, *Festuca*, *Aira*, *Hierochloe*, *Stipa*. In Tibetan regions a nettle abounds at upwards of 16,000 feet, and some *Artemisiæ* are the only early Compositæ in flower.

August.—Mean temperature (7000 feet) 61·7°; of maxima 66·1°, and minima 57·4°; of daily range 8·7°. Extremes 70° and 54·5°; of radiation—solar 133°, terrestrial 50°. Extreme differences—solar 62°, terrestrial 3·5°. Mean dew-point 60·4°; saturation 0·97. Rain 29·454 inches (means of 4 years 33·320 and 24·510 inches). In 1849 26·811 inches fell, and it rained every day but one, 10·802 inches falling after sunrise, and 16 after sunset. In the interior, on the other hand, at the same elevation, I experienced only 12·45 inches of rain, of which 8·29 fell in the night, and 4·16 during day. It rained, however, more or less nearly every day.

Vegetation in the lower region is at its fullest vigour. The common bracken (*Pteris aquilina?*) covers the ground, with a yellow *Cucurbitacea*. Many annuals that flowered in May and June are passing to seed, as *Cyrtandraceæ*, balsams, and begonias, but still many species are in flower. *Umbelliferæ*, which are rare below 9000 feet, flower, together with *Anemone vitifolia*, various *Hedychia*, some very magnificent. *Sparganium* blossoms, and *Colquhounia*, the small-flowered *Neillia*, *Ceropegias*, *Cuscuta*, many *Cucurbitaceæ*, especially *Trichosanthes*, tree *Araliaceæ*, the sweet *Buddleia*, *Ophelia*, *Clematis*, *Tricyrtis*, *Passiflora*, *Myrsine*, and *Embelia*, yellow honeysuckle,

Xanthoxylon, *Hypericum*, *Osbeckia*; a few thistles commence flowering, with gnaphaloid *Compositæ*, but not so freely or fully as *Eupatorium*, blue *Cichoraceæ*, *Myriactis*, *Callimeris*, two *Artemisias*, *Picris*, *Inula*, *Doronicum*, and *Mulgedium*. In open places at 8000 feet *Euphrasia*, *Drosera peltata*, *Neottia æstivalis*, *Dipsacus*, *Halenia*, and Erigerons flower.

In the kitchen-garden potatoes are planted with manure, and towards the end of the month the haulms of the early sorts wither, and the roots are stored. Table vegetables are abundant, with legumes of all kinds, turnips, radishes, carrots, lettuce, all varieties of vegetable marrows, squash, cucumbers, and asparagus, the latter generally small and woody. In the flower-garden are dahlias, marigolds, sunflowers, China roses, lupines, mignonette, larkspurs, rose-campions, œnotheras, heartsease, all thriving tolerably if protected from the rain, but it is better to keep them back till the following month.

There is little native cultivation carried on. Rice and other cerealia are in ear above 7000 feet, and maize is in flower just below that.

Animal life swarms in this month, especially insects. Cicadas and glow-worms ascend above 8000 feet. *Libellulæ*, *Tipulæ*, *Cynthia cardui*, and *Papilio Machaon* are very frequent at 6000 to 10,000 feet. Mosquitoes in myriads and countless leeches, with sandflies, swarm at 6000, and ascend to 8000 feet, the leeches and sandflies to 12,000. Swampy places become feverish even at 6000 feet.

Second, or Middle Region.—Above 9000 feet vegetation is also in its prime, from the abundance of *Compositæ* which adorn the skirts of the woods and open places, especially beautiful senecios, thistles, *Mulgedium*, *Aplotaxis*, *Dolomiaa*, *Ligularia*, and *Saussurea*, *Callimeris* and abundance of *Erigeron*, *Doronicum*, *Clematis* blossoms freely. Gentians, *Halenia*, *Ophelia*, &c., are all in bloom, with the most of the *Umbelliferæ*. Saxifrages form masses of golden blossoms at 12,000 to 13,000 feet, mixed with *Cyananthus*, *Codonopsis*, *Scrophularia*, *Polygona*, *Fumaria*, and *Corydalis*, *Oxyria*, *Primula denticulata*, *Salvia*, *Delphinia*, tall aconites, terrestrial *Orchideæ*, *Lilium Thomsoni*, *Verbascum*, and many other European genera.

Third, or Arctic Zone.—Some beautiful primulas are still only in flower, near the snow, at 15,000 feet, with many species of *Corydalis*, *Nardostachys*, *Chrysosplenium*, *Menziesia*, *Seda*, *Saussurea*, *Parnassia*, yellow *Drabas*, and *Androsaceæ*, at the southern passes, which, being in a more rainy climate, are backwarder. In the northern or drier parts, again, *Artemisiæ* appear, with *Delphinium Brunonis*, various *Cyananthi*, *Vero-*

nisa, *Kœnigia*, 6 potentillas, *Anaphalis*, *Serratula*, and many grasses, carices, and *Junci*.

September.—Mean temperature (7000 feet) 60° ; of maxima 64·7, and minima 55·2 ; of daily range 9·5°. Sunk thermometer 60°. Extremes of temperature 70° and 51·5° ; of radiating thermometers—solar 142°, terrestrial 47·5°. Extreme differences—solar 70°, terrestrial 10°. Mean dew-point 58.5° ; saturation 0·95°. Rain 15·762 inches (mean of four years 20·375 and 13,410). In 1849 15·675 inches fell, 3·621 by day, and 12·054 by night. It rained all the month except on 5 days, but most frequently at night. The first fortnight of this month is usually a continuation of the August humid weather, when it holds up for a week or so previous to the equinox, which is ushered in by violent electric disturbances and heavy gales.

The most prominent botanical feature of the month is the abundance of *Labiatæ*, especially *Plectranthi*, *Elsholsia*, *Craniotome*, *Colquhounia*, *Prunella*, *Ajuga*, *Scutellaria*, *Nepeta*, and *Melissa* ; and graphaloid compositæ, especially species of *Anaphalis*, whiten the ground in some places. *Osbeckia* is in full bloom, with white and shrubby polygonums. Many *Urticeæ* flower, but they are insignificant green plants. March and April flowering species are generally in seed. *Acanthaceæ*, of which there are very few, flower.

In the garden the vegetables are, besides those of August, more *cruciferæ*, as kohl-rabi and savoys, with tomatoes and capsicums. Peas and beans are sowed for early crops, with cabbage, turnip, beet, radishes, and spring crops of all kinds. Peaches redden and fall off the trees without ripening. Strawberry-beds are cleaned and runners planted ; rose-cuttings made. Rice and other cerealia are cut at 4500 feet, but not higher.

Second, or Middle Zone.—I passed the latter part of August and beginning of this month at 11,000 feet, considerably north of Kinchinjunga, in a very moist valley, with patches of snow in gulleys at 12,000 feet, where, however, the rain-fall was less than half that at Darjiling. From the 8th to the end of the month I camped at 15,400 feet, and experienced only 1·67 inches, whilst 9·993 fell at Darjiling. A good deal of this was in the form of snow, which lay for several days at 16,000 feet, as early as the 9th. At the equinox the snow lay three days around my tent, but melted again. In the more southern parts of Sikkim (in the position of P on the woodcut) the September snow-fall sometimes lies till the following April or May. The weather was constantly misty and foggy at my position, but was always clear though cloudy when I went into Tibet. This is a fruiting month everywhere above 13,000 feet; the barley and Fagopyrum crops are cut, and turnips and radishes gathered ;

the cattle are driven down to 12,000 feet early in the month, and to 10,000 feet towards the end. Dandelion, *Erigeron*, and other compositæ are still in full flower.

Fourth, or Upper Zone, above 15,000 feet.—Many plants continue in flower early in the month and to beyond the middle, as beautiful *Cyananthi*, Gentians, *Elsholsia*, *Caltha*, *Taraxanem*, *Prunella*, curious *Lactuceæ*, *Saussureæ*, and *Serratulas*, *Leontopodium*, and other Gnaphaloid compositæ. Small *Polygona*, *Primulæ*, and indeed all June and July flowering plants, ripen their seeds. By the 21st vegetation may be said to be at an end, the grasses change colour, and severe frosts set in. Birds migrate south, and the Hoopoe and various small birds are occasional visitants on their passage to warmer climates.

October.—Mean temperature (7000 feet) 58°—of maxima 66·5°, minima 49·5°; daily range 17°; sunk thermometer 59°; extremes of temperature 68° and 43·5°; of radiating thermometers — solar 133°, terrestrial 32°; extreme differences from temperature of air—solar 65°, terrestrial 12°. Mean dew-point 52·5°; saturation 9·88. Rain-fall 8·66 inches (mean of four years 17·964 and 5·50). This is one of the most variable months in the year as regards the distribution of both heat and moisture. Fine weather almost invariably follows the equinoxial gales, and sometimes lasts. October has been described to me as a glorious, cloudless month, without a drop of rain. In 1848 there was more bad weather than good, with heavy squalls, thunder and lightning, and nearly 18 inches of rain fell. In 1849, again, very little rain indeed fell, but the month was so uniformly foggy and damp, that the rains were not considered over till November; yet during twenty days no rain fell at all. The same irregularity marks this season at all elevations, and I experienced more rain at 13,000 feet, in an almost Tibetan climate, than fell at Darjiling, owing probably to the condensation of the southerly wind over the September snow-fall, which had already lowered the snow-line in some parts of Sikkim.

In the lower zone there are still plants to flower, as *Prinsepia*, the beautiful blue *Crawfurdia*, *Eleagnus*, and *Balanophora polyandra*. Various species of *Clematis* also flower, with *Camellia*, *Eurya*, *Cuscuta*, *Symplocos*, *Prunus*, *Wightia*, a late-flowering *Michelia*, *Aplotaxis*, the superb *Luculia gratissima*, fragrant *Olea*, *Bucklandia*, *Eleagnus*, and many parasitical *Orchideæ*. The apple and other wild fruits ripen.

In the garden the early frosts are apt to do injury; potatoes should be all housed; celery is planted out in trenches; cabbages and kohl-rabi in drills. The garden should be all cleaned and weeded for planting spring vegetables before the end of the month.

The natives gather in all crops between 6000 and 8000 feet this month, including the various millets, which yield 200 to 400 fold, and the unirrigated rice grown in slopes, and producing 80 fold on the average.

Second, or Middle Zone.—Above 14,000 feet the scene is more wintry than autumnal, but below that many *Compositæ* and *Umbelliferæ* continue in flower, and some in fruit; the *Coniferæ* all have fully formed cones; some *Clematis* flower with *Prinsepia*, and blue *Crawfurdia* and the nut. The larch leaves turn yellow and then red previous to dropping. Belts of scarlet girdle the forests from the abundance of berberries, whose leaves change colour. The birch turns golden yellow, *Pyri* and maples red and yellow, whilst the *Abies Webbiana* and junipers are still black, the grass brown, rhododendrons a bright verdegris green. Of the latter some species throw out a few flowers, but most are in seed, as are wild currants, cherries, berberries, apples, hips, and Stauntonia, which latter affords the best wild fruit of this region and that below it, except *Rubi*.

November.—Mean temperature (7000 feet) 50°—of maxima 56·5°, minima 43·5°: daily range 13°. Sunk thermometer 54°. Extremes of temperature 63° and 38°; of radiating thermometers, —solar 123°, terrest. 30°: extreme difference from temperature of air—solar 68°, terrest. 12°. Mean dew-point 46·5°; saturation 0·89°. Rain-fall 0·4°. This is the least rainy month of the year, sometimes no rain falls, and it seldom exceeds a few tenths of an inch. Drought is sometimes experienced, with a bright clear sun by day and sharp frost at night. The sun's rays are very powerful, considering how low the temperature is, but the air is bracing and pleasant, like an English April.

The *Bucklandia* flowers in this month at 6000 to 7000 feet, a magnificent tree as regards form and foliage; *Wightia*, a scandent Bignoniaceous tree, also blossoms profusely, bearing no leaves, and forming immense masses of red in the forest; *Pittosporum* blooms, and a *Prunus* like *Padus*, whose leaves are excellent fodder for cattle. Alder is in catkin, and the yellow *Daphne Gardneri*, a very beautiful plant, scents the air; nettles flower profusely, and *Cuscuta*, with the great shrubby *Teucrium*. All crops are now housed, and wheat and barley sown at 9000 feet to be reaped in May.

In the upper regions the snow-line descends to 14,000 feet.

December.—Mean temperature (7000 feet), 43°; of maxima 51·6°, and minima 34·9°; daily range 16·7°; sunk thermometer 48°. Extremes of temperature 56° and 32·5°; of radiating thermometers—solar 108°, terrestrial 26°. Extreme differences from temperature of air—solar 77·2°, terrestrial 10°. Mean dew-point 30°; saturation 0·61°. Rain-fall 0·45. This month

is sometimes very dry; it was unusually so in 1837, when Dr. Chapman's register was kept: his reduced wet bulb observations are those from which I have worked the dew-points. Hoar frost is of almost nightly occurrence in December, but the cold is never extreme. About Christmas a storm is experienced, and a great quantity of snow falls in the upper regions, at as low elevations as 9000 feet, where I have seen 3 feet: much of this melts, however, owing to the warmth of the soil.

January.—Mean temperature (7000 feet) 40°; of maxima 47·2°, and minima 32·8°; daily range 14·4°; sunk thermometer 45°. Extremes of temperature 56° and 29°; of radiating thermometers—solar 119°, terrestrial 16°. Extreme differences from temperature of air—solar 72°, terrestrial 12·7°; mean dew-point 34·3°; saturation 0·84°. Rain-fall 1·718 inches; mean of three years 0·30 and 4·27. January is generally a stormy month, with bitterly cold, often violent winds, hail, sleet, and sometimes snow at Darjiling, and as low as 6000 feet, never lying beyond a few hours at the latter elevation, and it is rare for 3 inches to remain as many days at 7000 feet. Much snow falls about the middle of the month in the upper regions, the ground being covered several feet deep at 13,000 feet, and the snow-line is lowered to about that elevation, and does not recede from that till April or May. I found the soil at this elevation frozen for 16 inches, but warm below that, and as high as 34·5° at less than 3 feet deep.

February.—Mean temperature (7000 feet) 42·1°; of maxima 50°, and minima 34·2°; daily range 15·8°; sunk thermometer 47°. Extremes of temperature 57° and 25·5°; of radiating thermometers—solar 124·0°, terrestrial 23·°. Extreme differences from temperature of air—solar 78°, terrestrial 15·3°. Mean dew-point 36·7°; saturation 0·85°. Rain-fall 0·916; mean of three years 2·047.

This is also a stormy and cold month, with a good deal of thunder and lightning, hail, and sometimes snow. Turnips, carrots, beet, and cabbage are the chief garden vegetables; peas blossom freely in spite of the weather; tender plants are protected by matting; artichokes and rhubarb are manured; lupines, marigolds, and stocks are still in flower. Snow that falls at 11,000 and 12,000 feet remains till April: there are no plants of any consequenee in flower above 6000 feet.

I append a meteorological register of the separate months for convenience of reference, but at the same time must remind the reader that it does not pretend to strict accuracy. It is founded upon observations made at Darjiling by Dr. Chapman in the year 1837, for temperature and wet bulb only; the other data and some modifications of the above are supplied from a very careful

collection of a multitude of observations of my own. The means of the month are taken by meaning the daily maxima and minima, which I think gives too high a result. Those for terrestrial and nocturnal radiation are accurate as far as they go, that is to say, they are absolute temperatures taken by myself, which may, I believe, be recorded in any year, but much higher are no doubt often to be obtained. The dew-points and saturations are generally calculated from the mean of two day observations (10 A.M. and 4 P.M.) of the wet bulb thermometer, together with the minimum, or are taken from observations of Daniell's hygrometer. The dew-point and temperature are assumed to coincide only at the hour of minimum temperature; but as they do coincide for, on the average, 10 hours of every 24, this method obviously gives too low a dew-point. On the other hand, the wet bulb observations, or hygrometer, were never taken at the hours of greatest dryness; and as I find the mean of the temperatures of 10 A.M., 4 P.M., and the minimum to coincide within a few tenths with the mean temperature of the whole year, I assume that the mean of the wet bulb observations of the same hours will give a sufficiently accurate approach to that of the 24 hours. The climate of Darjiling station has been in some degree altered by extensive clearances of forest, which render it more variable, more exposed to night frosts and strong sun, and to drought, the drying up of small streams being one direct consequence. My own observations were taken at Mr. Hodgson's house, elevated 7450 feet, the position of which I have indicated at p. 2 of this volume (in a note), where the differences of climate due to local causes are sufficiently indicated to show that in no two spots could similar meteorological results be obtained. At my station, for instance, the uniformity of temperature and humidity is infinitely more remarkable than at Dr. Chapman's, possibly from my guarding more effectually against radiation, and from the greater forest about Mr. Hodgson's house. I have not, however, ventured to interfere with the temperature columns on this account. Such as they are, I believe they afford amply sufficient data for the horticulturist who is anxious to exert his skill and ingenuity in the cultivation of Himalayan plants in general, and especially of Sikkim ones, though they will little avail him except he be previously master of the climate of England, for which purpose I would most strongly urge the study of Mr. Daniell's essay before alluded to, and the many papers in this Journal and elsewhere of Mr. Thompson, of the Horticultural Society's Gardens, which contain a vast amount of valuable matter, carefully collected and extremely well arranged.

—	Mean Shade.	Max. Shade.	Max. Sun.	Greatest Diff.	Mean Max. Shade.	Minim. Shade.	Minim. Rad.	Greatest Diff.	Mean Minim. Shade.	Mean Daily Range of Temp.	Sunk Therm.	Mean Dew Point.	Mean Dryness.	Force of Vapour.	Mean Saturation.	Rain in Inches.
January .	40·0	56·0	119·0	72·0	47·2	29·0	16·0	12 7	32·8	14·4	46·0	34·3	5·1	·216	·84	1·72
February	42·1	57·0	124·0	78·0	50·0	25·5	23·0	15·3	34·2	15·8	48·0	37·2	3·9	·239	·87	0·92
March .	50·7	66·5	120·0	60·0	58·4	37 0	27·8	8·7	43·1	15·3	50·0	45·8	5·8	·323	·82	1·12
April .	55·9	68·5	125·0	66·0	63·7	38·0	33·0	16·0	48·1	15·6	58·0	49·8	6·6	·371	·80	2·52
May . .	57·6	69·0	125·0	65·0	65·3	38·0	40·0	10·0	50·0	15·3	61·0	54·4	2·7	·434	·91	9·25
June . .	61·2	71·0	126·2	62·2	66·7	51·5	47·0	4·8	55·8	10·9	62·0	59·5	2·0	·515	·93	26·96
July . .	61·4	69·5	130·0	62·0	65·5	56·0	52·0	3·5	57·3	8·2	62·2	60·7	0·8	·535	·97	25·34
August .	61·7	70·0	133·0	62·0	66·1	54·5	50·0	3·5	57·4	8·7	62·0	60·4	1·1	·530	·96	29·45
September	59·9	70·0	142·0	70·0	64·7	51·5	47·5	10·0	55·2	9·5	61·0	58·5	1·4	·498	·95	15·76
October .	58·0	68·0	133·0	65·0	66·5	43·5	32·0	12·0	49·5	17·0	60·0	52·5	4·2	·407	·86	8·66
November	50·0	63·0	123·0	68·0	56·5	38·0	30·0	12·0	43 5	13·0	55·0	46·5	3·2	·331	·90	0·11
December	43·0	56·0	108·0	77·2	51·6	32·5	26·0	10·0	34·9	16·7	49·0	31·8	10·6	·198	·69	0·45
Mean .	53·5	65·4	125·7	67·3	60·2	41·3	35·4	9·9	46·8	13·4	56·2	49·3	3·9	·383	·88	122·26
London .	49·9	.	.	.	58·5	.	.	.	41·3	17·2	.	44·3	5·6	·342	·83	24·2
Sikkim Extreme	.	71·0	142·0	78·0	66·7	25·5	16·0	15·3	32·8	17·0	.	.	10·6	·535	·97	29·45
Extreme London	.	94·4	130·0	39·0	74·0	−4·5	−12·0	13·0	31·9	22·4	.	.	8·5	·482	·93	2·97

VII.—*On Grape Mildew.* By Hugo v. Mohl.

[Translated from the *Botanische Zeitung,* Jan. 2, 1852.]

The attention of the readers of the *Botanische Zeitung* has frequently been called to the disease which has attacked the vines for some years in the west of Europe, and has been extremely injurious to them. Since this epidemic has passed over the boundaries of Germany, and the history of its previous course gives ground for fearing that it may spread widely amongst us next year, some more particular account, which I am enabled to give from observations made last autumn in Switzerland, may not be unacceptable.

How far it deserves to be called a new disease may be left undecided. Even supposing it to have appeared from time to time in isolated spots, it must have been in a very trifling degree, since it did not excite the attention of the cultivators of vineyards, and the fungus attendant on it was unknown to botanists. It was calculated to attract the greater interest last year because, after its first appearance at Margate (see Bot. Zeit., 1848, p. 376), it gradually spread into France, where it appeared at Versailles, in 1848 (see Bouchardat in Comp. Rend. xxxiii. p. 145), the next year, to some extent, at Paris, and finally, in 1851, reached the south of France, at the same time rapidly travelling the whole length of Italy from the coast of Liguria to Naples, then, as autumn approached, taking a retrograde course through the Tyrol as far as Botzen, overrunning nearly the whole of Switzerland northwards to Winterthur, and, at last, trespassing on certain isolated points of Germany at the Hardgebirge, in Baden at Salem, and in Würtemburg at Stuttgart and Cannstatt.

On its first appearance in England, as also at Versailles, Paris, and Grenoble, it seems to have been confined to the vines in hothouses, and from thence to have spread to those on walls, and, finally, to the vineyards. In districts where grapes are cultivated exclusively in the open air, the disease in 1851, in many places which I visited, as, for instance, in great part of Switzerland and Würtemburg, attacked those vines which were grown on walls, and, where it had attacked the vineyards, the bunches on the walls suffered far more than those on vines in the open field; and I was convinced that, in particular spots, where the malady was at present much confined, it had passed from the trellises to the neighbouring vineyards. It reached the greatest height on those trellises which stand under the wide-spreading roofs of the Swiss houses, and by which they are protected from the rain.

From its very first appearance it was observed to be constantly attended by a fungus (*Oidium Tuckeri*, Berk.). This fungus resembles, to the naked eye, a white, mealy coat, which, according to the virulence of the disease, forms a scarcely visible powder, or a tolerably thick crust. In slight cases the fungus arises only in certain places of the plant, and, without any definite rule, sometimes on the bark of the two-year-old shoots, sometimes on the leaves, sometimes on the stalk of the bunches, or on the berries themselves, but on such parts only as are covered with a living cuticle, and never on the dead bark of the older branches. In extreme cases the fungus covers every part which has developed itself in the course of the summer so thickly that at the distance of twenty paces the vine is at once known to be diseased.

A question has arisen in various quarters whether this fungus is a peculiar species, and confined to the vine; Marie, for instance (Comp. Rend. xxxi. p. 312, 454), Guérin-Méneville, and Balsamo Crivelli (l. c. xxxiii. p. 295) assert that the same fungus grows on many other plants, and that *Oidium Tuckeri* is identical with *Oid. leucoconium*. Since it depends so much on the peculiar views of individuals, whether two allied forms are considered as varieties or distinct species,* I shall not consider this point more narrowly,† though the difference between *Oidium Tuckeri*, with its clavate incrassated threads surmounted by only one or two spores, and *O. leucoconium*, whose threads produce a long row of spores, appears so striking, that we must necessarily allow the existence of a specific difference. The question seems to me far more important whether *Oidium Tuckeri* is capable of living on other plants besides the vine. If this were the case, it would be probable that it might spread from diseased vines to neighbouring plants. This, however, seems decidedly not to be the case;‡ at least, notwithstanding the most careful examination in a garden where plants of the most different families stood close to highly diseased vines, I could not find a trace of the fungus on any plant whatever; it did not attack even *Ampelopsis quinquefolia*, although the boughs were intertwined

* No great stress can be laid on the size of the spores, since in those of *Oidium Tuckeri*, which I figured by means of Sömmering's apparatus, the major axis varied from $\frac{1}{100}$ to $\frac{1}{72}'''$, the minor axis from $\frac{1}{200}$ to $\frac{1}{108}'''$.

† It is very true that in fungi the reproductive organs vary greatly in size; but if the mean in every case be ascertained, it will be found available for the distinction of species. To take a familiar example, peas may be found in any undressed sample no larger than tares, and yet it may be safely asserted that peas have much larger seeds than tares.—*Transl.*

‡ It has been observed at Margate to extend to Indian Chrysanthemum placed beneath vines which were affected to a great extent by the disease.—*Transl.*

with the diseased vine shoots on the same wall. Whether the plant is capable of attacking American vines I am not able to say, since in the only vineyard in which I saw a quantity of these vines, all were healthy, a circumstance which may, however, be accidental, since the vineyard itself was only slightly infested with the disease.

As in so many other cases of fungi which accompany disease, so in the grape mildew, the question has arisen whether the fungus is the cause or the consequence of the malady; and so, also, as in many analogous cases, the original ground of the evil has been attributed to insects, as, for instance, by Robineau-Desvoidy (Comp. Rend. xxxiii. p. 343). This latter view seems to me to be decidedly wrong. I am very far from wishing to intimate that Robineau's observation of the presence of an *Acarus* on diseased vines is false, though, after the most careful microscopical observations of many diseased vines, in all stages of the malady, and in different places, I have been unable to detect any insect, and therefore can only attribute their occurrence, as observed by M. Robineau, to mere accident.

A far more difficult question to answer is that, whether the fungus is the cause or consequence of the disease. Were the fungus an entophyte, did it arise from a visible demonstrable alteration of the contents of the cells, did it break out from within the plant to its external surface, the latter position might be considered as proved.* The contrary, however, of all these things is the case. Not the slightest trace can be discovered of any disease of the vine anterior to the appearance of the fungus, which creeps over the cuticle of the plant, does not protrude into its tissues, and much less † arises within previous to bursting forth into the free air. These circumstances make it probable that the fungus first affects the plant on which it grows by decomposing the juices of the superficial cells, and impeding their growth in the same way in which *Achlya prolifera* injures the aquatic animals on which it grows, and as *Merulius destruc-*

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* *Oidium leucoconium* is an entophyte, exactly as *Botrytis infestans* and the group of allied species which grow on green leaves are entophytes. The probability therefore is *primâ facie* that *O. Tuckeri* is an entophyte.—*Transl.*

† It is figured in the 'Gardener's Chronicle' as making its way, like other *Oidia*, through the stomata. Léveillé, however, like Mohl, denies that this is the case; and Duchartre asserts truly that there are no stomata (or at least extremely few) on the upper surface of the vine leaves, on which the fungus grows according to Continental authorities. At Margate, however, it was more abundant on the under than on the upper surface of the leaves. A re-examination of the matter must be deferred to the summer, as it is impossible to make out anything satisfactory from dried specimens. Indeed, like many other moulds, it is very difficult to preserve in the Herbarium, on account of the ravages of mites.—*Transl.*

tor produces decay in dead wood. Many experiments also seem to prove that the cause of the disease is to be found in the fungus, according to which the further diffusion of the evil is greatly repressed by the removal of the first affected shoots on a wall, the destruction of the fungus through washing, &c.*

The indisputably contagious character of the disease is also explained only by the fact that the fungus causes the malady, for it is easily imagined how the lightest breeze may carry the innumerable quantity of spores which it produces, and which are only $\frac{1}{100}'''$ in length, from the diseased to the sound vines.

The appearances which the diseased vines present are as follows. The spots on the green bark of this year's shoots on which the fungus has begun to vegetate are discernible by a faint cloud in their green tint before the fungus itself is visible to the naked eye. The fungus consists at this time of minute extremely delicate threads, visible only through a good lens, resembling those of a spider, which creep on the surface of the cuticle, forming an irregular web. The bark has assumed in the spots which are attacked, frequently not exceeding $1'''$ in diameter, a somewhat deeper tint; these spots soon increase in diameter as the disease spreads, become confluent, and change, in consequence of the death of the superficial cells, into a chocolate brown. Microscopic observations show that the depravation of the juices which produces this change of colour, and the death of the diseased cells, is confined to the most superficial strata, while those which lie deeper, as well as the wood, remain perfectly sound. Under these circumstances the malady, as far as it attacks the branches, seems a very unimportant evil, and there is no danger of the death of the vines which are attacked, inasmuch as the external coats of the bark must, in the natural course of things, be dried up in the ensuing autumn and winter, and thrown off during the next year. The fungus exercises a still smaller influence on the leaves than on the branches; at least I could not remark, even in those vines which were thickly covered with the fungus to the very tips of the shoots, that the vegetation of the leaves was really affected.

As regards the fruit the case is far otherwise. Here also only the extreme layer of cells at first suffers under the attack, while the inner parts of the fruit, as far, at least, as may be concluded from microscopic observation, remain perfect. The appearances which the affected berries exhibit differ much, according to the

* I could not institute the *experimentum crucis* of hanging diseased bunches which I had brought to Tübingen, where the malady has not yet intruded, on untainted vines, with the view of proving whether it could not be communicated by contagion, because I would not subject myself to the responsibility of contributing to spread the evil in a wine district.

time which has elapsed since they were infested, the greater or less vigour of the fungus, &c. When the fruit is sharply attacked, and at a time when it has arrived at about half its growth, or when it is scarcely so large, since the outer diseased skin cannot keep up with the expansion of the juicy parenchym, it splits longitudinally into many lobes, so that the seeds, which are more or less perfectly developed, are exposed, as in the ruptured capsule of an *Euonymus*. These fissured berries seem, under all circumstances, incapable of further development; they remain small, although they hang on the vine till late in the autumn, and seem at last to dry up or rot; at least I saw in none any symptoms of becoming ripe. On the contrary, if the fruit is attacked towards autumn, when it is already much advanced in its development, the influence of the fungus is too weak to prevent the production of ripe, perfect, normal fruit, even when the stalks of the berries are thickly overrun with its threads. Between these two extreme cases a number of intermediate conditions naturally occur, in which the berries do not crack, but are arrested in their growth, and never ripen or become profitable.

The question whether the use of diseased grapes has any noxious consequences, seems not to be decided. While, on the one side, a string of examples from French papers is brought forward in the *Réforme Agricole*, according to which diseased grapes are injurious, producing colic and vomiting, express experiments to a contrary effect have been communicated to me in Lausanne. Probability is in favour of the latter opinion, since the extent to which the malady has lately reached in France could not fail to have afforded a number of well-established examples, if the diseased grapes were really injurious, for they were frequently eaten by children.

It is a natural question, what will be the condition of the disease in future; is it transitory, brought on and favoured only by accidental and temporary circumstances, or is it a durable evil, and what remedy, in this case, can be administered for the warding off or diminution of the malady? We are treading here on dangerous ground. for it is notorious how little, for the most part, in epidemic diseases, science is in a condition to answer such questions, and the potato murrain affords a lamentable instance amongst vegetable epidemics how little the numerous solutions of the difficulty, and these frequently given with no less confidence than imperfect knowledge, serve for the removal of the evil.

The question as to the future condition of the malady, whether it will vanish or extend step by step to the districts which at present are uninfected, is, from the very nature of the case, per-

fectly incapable of answer. The prospects afforded by its previous history are by no means comfortable. We have to contend with an enemy against which, as regards its diffusion, we are perfectly powerless, since every breeze may bring thousands of its minute microscopic germs from an infected district to one which is at present untainted. Nor less is any notion of the destruction of the fungus on the diseased vines, by washing, fumigation, &c., in places where vines are extensively cultivated, completely out of the question. Under these circumstances there remains only the by no means powerful consolation that, as in analogous diseases produced by other fungi, even though it may not entirely vanish, it may be expected to be at all widely extended, and, consequently, decidedly injurious, only in certain years. A remedy is the more difficult, or rather the more impossible, because it relates to a woody perennial plant, and therefore a multitude of variations in the mode of culture which are available in annual plants, as different ways of planting, the choice of a favourable site, rotations of cropping, &c., are clearly inapplicable. It appears also that all such remedies as depend on variations of culture, even were they more easily applicable to the vine, would not be crowned with much success, since, at least as far as my own experience goes, no particular rules are deducible from the condition of diseased vineyards, according to which the occurrence of the evil is regulated as regards the exposure towards a particular quarter of the heavens, the geological nature of the subsoil, the lower or higher training of the plants, the age of the vineyard, the circumstance whether it had been recently planted on virgin soil, or was of the growth of many centuries, &c., since none of these points seem to have the slightest influence, and only in particular spots, a low situation and the moisture of the soil, appear to be favourable. Although particular kinds of vines, as the crowfoot (Trollinger) and muscatels, suffer extremely, this is but a proportional difference, since in other places sorts of the most various nature were attacked ; and even should experience clearly prove the especial tendency of particular varieties to contract the infection, this point could scarcely induce any great alteration in the cultivation of the vine, as the choice of sorts depends upon so many other circumstances.

At least for the present what is possible to be done in the way of alleviation must be confined to culture on a small scale in conservatories or on walls, since the small quantity of vines which are cultivated in such situations admit of some special treatment. These situations are moreover, as was remarked above, the most perilous, because they afford the most favourable ground for the malady, and form the centre from which it extends to the vine-

yards, for which it is so much the more dangerous, since the artificially accelerated development of the vine permits its occurrence some months earlier than in the open air, and the disease is in a condition to attack the bunches at a much younger stage of growth. It is a great question whether, now that the disease is widely spread, any benefit would be derived from preventing the artificial growth of grapes, as has been proposed, on one side, even supposing it were, or could be, put in practice; on the other hand, there is no doubt that the owners of vines which grow in conservatories or on walls can use remedies against the malady when appearing in such situations. It seems at least, after the experiments made in England and France, to admit of no doubt that the removal of the parts first diseased, and the washing with solutions of lime, sulphuret of lime, alum, soap, &c., besides fumigation with tobacco smoke, and dusting with sulphur, are attended with advantage.

VIII.—*An Abstract of Meteorological Observations made in the Garden of the Society, in continuation of those published* vol. vi. p. 132. By Robert Thompson.

1851.

	Thermometer.			Rain.	Barometer.			Mean Moisture.
	Max. in Sun.	Min. by Radiator.	Mean of Shaded Therm.	In pts.	Max.	Min.	Mean.	
	°	°	°					
Jan.	58	20	40·07	3·07	30·328	29·111	29·741	992
Feb.	62	13	38·44	0·90	30·375	29·490	29·991	968
March	69	21	41·72	3·57	30·379	28·753	29·705	934
April	77	19	44·56	1·65	30·103	29·373	29·834	897
May	88	24	51·16	0·74	30·470	29·598	30·006	784
June	107	33	59·21	1·33	30·383	29·551	30·017	796
July	94	34	60·71	3·90	30·140	29·473	29·844	808
Aug.	103	32	62·79	2·03	30·355	29·669	30·018	850
Sept.	95	28	55·15	0·42	30·572	29·340	30·131	875
Oct.	85	28	51·25	2·01	30·386	29·012	29·835	958
Nov.	67	11	35·86	0·55	30·434	29·336	29·887	961
Dec.	60	12	38·88	0·62	30·521	29·543	30·234	992
Means	80·41	22·91	46·65	20·79	30·370	29·353	29·937	901

General Observations.

January.—The weather was in general remarkably fine for the period of the season, and operations in the open air were carried on with less interruption than is usually experienced in the winter months. Although the quantity of rain amounted to nearly double the average for the month, yet it mostly fell in the nights; the days were often exceedingly fine. The wind was from north-east one day, and from west two days; in all the rest of the month it came from the warmer quarters of south, south-east, and south-west, and owing to this the mean temperature was fully 2° above the average.

February.—The day temperature of this month was equal to the average, but that of the nights was 3½° colder than usual. The night temperatures averaged 4° lower than those of the preceding month. The barometer stood above the average height. The quantity of rain was less than an inch, or little more than half the usual quantity. Some sleet fell on the 27th; but throughout the month the ground was not at any time whitened by snow. On the whole the weather was very favourable for all out-door operations.

March.—The first week was fine; but from the 9th to the end of the month there were only six days in which rain did not fall. The amount of rain was fully 3½ inches, or upwards of 2 inches above the average. The barometer was generally low during the last three weeks, and remarkably so on the evening of the 22nd. Westerly winds were prevalent. The average mean temperature was nearly maintained. The morning of the 14th was frosty with slight fog; heavy clouds formed during the day; the evening was hazy, and at night nearly ¾ inch of rain fell. A mock-sun was observed between 6 and 7 A.M. on the 29th; the forenoon proved boisterous, showery, with sunny intervals; and one-third of an inch of rain fell between 8 A.M. and 1 P.M.

April.—The amount of rain was exactly equal to the average. The mean temperature was 2¾° below the average, and this may be attributed to the prevalence of north, north-east, and north-west winds. Fourteen nights were more or less frosty. Peaches and nectarines on walls suffered much, especially in gardens where no protection was afforded. In the Society's Garden fair crops of these fruits were saved by means of coping-boards, projecting about 9 inches. The last week of the month was very inclement. On the 27th there was a hail-shower between 5 and 6 P.M.; the stones were large, but not very hard; lightning was seen in the evening. On the afternoon of the 29th thunder was heard, and soon after large hail began to fall; the

stones were short-pyriform, and in substance resembled compact snow. On the 30th there were also hail-showers occasionally during the day.

May.—This month was generally cold and windy. The mean temperature of the days was only $1\frac{3}{4}$° below the average of the days in May, but the mean of the night temperatures was 4° colder than the average. The first four nights were frosty. Pears were then generally out of bloom, and a plentiful crop of young fruit had set, notwithstanding the previous cold nights, even as much as 7° below freezing, on the 26th and 27th of the preceding month. But the trees had not then been much excited by warm weather. They became, however, very much so in consequence of a warm south wind on the 8th, 9th, and 10th of the present month. On the latter of these days the thermometer rose to 70° in the shade. The sap was in rapid motion towards the young fruit, when it was suddenly checked by 5° of frost on the night of the 14th. The flow of sap appeared to have been in consequence diverted from the fruit, and afterwards appropriated by the foliage. At all events most of the former became yellow in a few days, and dropped, after it had endured, 17 days earlier, 2° more of frost, with much less foliage to shelter it.

June.—The mean temperature was about $1\frac{1}{2}$° below the average. The quantity of rain was nearly half an inch less than the usual amount; none fell after the 18th; and from this time to the end of the month the days were generally very hot. Occasionally, however, the nights were comparatively cold. On that of the 23rd the thermometer was within 3° of freezing, probably the effect of a brisk north-west wind on the 22nd. The 5th, 8th, and 16th were boisterous.

July.—Upwards of $1\frac{1}{2}$ inch above the usual quantity of rain fell in this month; yet there were many fine days, for nearly half the amount of rain fell on the 1st and 23rd. The morning of the 1st was hazy and mild; several peals of thunder were heard; and again about 8 P.M., lightning being then vivid, with rain falling in torrents. This rain, it may be remarked, and also that of the 23rd, came in the train of east winds, and not from south-west, as heavy and continued summer rains generally do. The mean temperature of the month was nearly 3° below the average.

August.—The mean temperature of the month was fully equal to the average. During the first three weeks the weather was, on the whole, exceedingly fine, with scarcely any rain excepting on the 17th. The barometer stood high throughout the month, although south-west winds were prevalent. The day of the 27th was fine; but during the night a greater depth of rain fell than in any 24 hours of the preceding 26 years, at least in this

locality. Before morning 1 inch $\frac{32}{100}$ had fallen. The 29th was showery, with hail between 1 and 3 P.M. On the 30th the temperature at night fell to 35°, and the radiating thermometer indicated as low as the freezing point.

September.—The weather throughout the month was almost uninterruptedly fine. Rain fell during the day on the 25th and 30th only; and altogether the quantity was very limited, scarcely amounting to half an inch. The barometer stood remarkably high; the height of the mercurial column was never under 30 inches from the beginning of the month up to the 20th. The mean temperature was 2° below the average, owing solely to the coldness of the nights, for the mean temperature of the days was not lower than usual. Frost occurred as early as the 9th, and some leaves of scarlet-runners and gourds were then blackened. On the 28th the common thermometer indicated 2° below freezing, and the radiating one 4° below that point. North-east winds were remarkably prevalent.

October.—The mean temperature of the month was about $\frac{3}{4}$ of a degree above the average. The depth of rain was about 2 inches, fully half an inch less than the average. The ground was previously very dry, and planting out was retarded in consequence. The quantity of rain in this month was sufficient to moisten the soil for this purpose; but it did not penetrate to the lower roots of trees and shrubs; for it was found that the soil under these still remained very dry.

November.—This was the coldest November that has been experienced for the last 26 years at least. The mean temperature was upwards of 7° below the average. 23 nights were more or less frosty. On the night of the 18th the common thermometer indicated 16° below freezing, and the radiating one as many as 21° below that point. The wind came chiefly from cold quarters—from north 10 days, north-east 4 days, and north-west 6 days. The amount of rain was very limited, being little more than half an inch. With the exception of that on the 23rd, none fell after the 12th.

December.—The mean temperature of this month was nearly equal to that of December deduced from the average of 26 years' observations, and it was 3° above that of the preceding month. The amount of rain was much below the usual quantity. With the exception of a very little on the 5th and 16th, none fell from the beginning of the month till the 19th. Reckoning from this date, and as far back as the 9th of the preceding month, there is a period of 40 days almost without rain. The barometer was unusually high.

Geothermometrical Observations.

1851.		Day of the Month.	Temperature of the Earth. 1 Foot.	Temperature of the Earth. 2 Feet.	Day of the Month.	Temperature of the Air. Day.	Temperature of the Air. Night.	Day of the Month.	Monthly Mean Temperature of the Air.
Jan.	Max.	4th	44°·50	44°·50	1st	54°·	51°·	1st	
	Min.	25th	38·	41·	24th	34·	22·	23rd	40°·07
	Mean	—	41·74	42·92	—	47·09	33·06	—	
Feb.	Max.	21st	43·	42·	18th	57·	47·	18th	
	Min.	17th	37·	39·50	2nd	40·	17·	16th	38·44
	Mean	—	39·73	40·98	—	47·46	29·03	—	
Mar.	Max.	29th	46·	45·	20th	58·	45·	25th	
	Min.	4th	38·	39·50	2nd	43·	24·	3rd	41·72
	Mean	—	41·48	41·95	—	49·93	33·51	—	
April.	Max.	25th	51·	50·	19th	65·	48·	21st	
	Min.	11th	43·	44·	6th	47·	21·	6th	44·56
	Mean	—	46·18	46·28	—	55·20	33·93	—	
May.	Max.	31st	57·50	54·	29th	75·	48·	20th	
	Min.	4th	47·	47·50	4th	50·	27·	14th	51·16
	Mean	—	51·34	49·77	—	63·26	39·06	—	
June.	Max.	30th	65·	63·	27th	91·	56·	8th	
	Min.	11th	55·	54·	10th	55·	35·	23rd	59·21
	Mean	—	58·70	56·71	—	71·40	47·03	—	
July.	Max.	2nd	65·	63·	2nd	82·	62·	31st	
	Min.	19th	59·	58·	24th	60·	37·	4th	60·71
	Mean	—	61·26	59·56	—	71·68	49·74	—	
Aug.	Max.	4th	66·	63·	12th	83·	62·	1st	
	Min.	31st	55·50	55·	29th	59·	35·	30th	62·79
	Mean	—	62·40	60·68	—	73·84	51·74	—	
Sept.	Max.	3rd	61·	58·50	1st	76·	59·	2nd	
	Min.	30th	52·50	52·50	26th	56·	30·	28th	55·15
	Mean	—	56·55	55·70	—	66·80	43·50	—	
Oct.	Max.	13th	56·	55·	11th	68·	55·	20th	
	Min.	31st	48·	49·	31st	48·	28·	16th	51·25
	Mean.	—	52·65	52·	—	59·	43·51	—	
Nov.	Max.	1st	46·	47·	1st	52·	39·	9th	
	Min.	30th	37·	38·	17th	35·	16·	18th	35·86
	Mean	—	41·18	41·96	—	43·96	27·76	—	
Dec.	Max.	21st	45·	44·	9th	54·	52·	9th	
	Min.	2nd	37·	38·	31st	36·	17·	26th	38·88
	Mean	—	41·26	41·06	—	44·67	33·09	—	

IX.—*On Spring-tenderness in Plants.* By George Lovell, Bagshot.

(Communicated March 4, 1852.)

That many plants, which pass uninjured through the ordinary severity of our winters, are often seriously damaged by a few degrees of frost in spring is a fact well known to all who pay the least attention to the cultivation of hardy plants; and the causes, too, are equally well understood. In winter the plant is at rest; its vegetative powers are in a comparatively dormant state. The tissues are solidified and more deficient in fluids than at any other season, and a combination of circumstances, not now necessary to be discussed, render it both physically and mechanically less susceptible to the influence of external agency. In a word, a plant is then less organic, or approaches nearer the condition of an inorganised mass, than when its vegetative and vital principles are in active operation, and exhibits a corresponding inert condition.

It is, I am aware, a prevailing opinion that this spring-tenderness, of which I am speaking, arises wholly from constitutional peculiarity—an hereditary quality, induced by the nature of the seasons in the country or district from whence any given plant may be a native, and which still continues to evince itself under adverse circumstances. But I believe that such peculiarities arise, not so much from a natural tendency in the individual to put forth its buds at a particular season, as from its being induced to do so from the influence of local circumstances attending the situation in which it may be placed. A change of country, with a corresponding relative alteration of season, would undoubtedly affect in a material degree any plant removed from one part of the globe to another, even though the seasons were in both identical in point of temperature, but different in time of occurrence. Yet careful attention to the peculiarity evinced would in a few seasons induce the plant to adapt itself in some degree to its altered conditions, or rather I should say circumstances may be suited to the plant, to enable it to take advantage of them.

Now I cannot believe that the most enthusiastic disciple of the doctrine of the hereditary transmission of qualities would venture to assert that, even admitting such peculiarity to cling to an originally introduced plant, it would show itself so decidedly in its descendants, removed perhaps some half-a-dozen generations from the ancestor. All gardeners know very well, that a plant may be made to change its periods of growth by artificial means. Take the vine as an example. Under ordinary out-door treat-

ment it is perfectly hardy in England, and does not begin to grow, except in a few rare instances, till after all danger from spring frosts is over. Sometimes it gets "cut" certainly. So does the oak, and much oftener too, an indigenous tree be it remembered; and the ash and the elm, and the most coy of our cultivated trees, the mulberry, often gets "nipped in the bud," though late in putting on its spring attire. But to return to the vine. Take one from the open ground, and by artificial means induce it to "break" for a few consecutive seasons at Christmas, and allow it to rest when others are in full leaf and fruit. The summer sun will scarcely prolong its vegetative season beyond what is required for its healthy economy; and, if you now remove it to the open air, its instincts will not teach it to hold aloof from the influence of excitable causes at a period when such would be fatal to it in its then unprotected condition. It will certainly for a few seasons exhibit a much greater tendency to vegetate at an unnatural season than one which had not been induced to do so artificially. But no one will believe that if seeds were obtained from a vine while under an unnatural period of growth, and plants obtained from them, that they too would *naturally* attempt to put forth their leaves at Christmas. I believe that in a great measure the periods of vegetation and its attendant phenomena may be changed in relation to the seasons, and that such phenomena do not result periodically and under apparent adverse circumstances from any inherent and unchangeable quality in the individual itself, but that it in a great measure depends on the circumstances by which the plant is surrounded, and that in proportion as those circumstances are under control or direction, so are the results which must arise from those causes. It may, however, be urged in opposition, that out-of-door culture is a very different affair as regards the management and modification of climate, from having to do with glass-houses and all the attendant aids for creating an artificial and spoiling a natural climate. I grant it; yet the action of natural climate may be much modified, and of course the results in a corresponding ratio, with reference to plants in the open air, and their tendency to subject their young growths to the nipping frosts of spring much obviated. It is not fair to condemn a plant as not being hardy purely because it gets its young growths cut off by spring frosts, and to discontinue its cultivation accordingly. The hardiest of our indigenous trees are often severely cut by their agency, yet we do not consider them the less able to withstand the climate, and merely view such as natural and unavoidable contingencies. And in a small number of trees this influence of frost could be wholly avoided if it were thought necessary.

A short time since I was conversing with a gentleman who

had spent much time upon the Himalayan mountains, in the district where the scarlet Rhododendron arboreum grew abundantly. He assured me that in their native habitats, when occupying warm southern slopes, they suffered much by the destruction of their blossom buds from the late frosts, almost as much as the early blooming kinds do in the gardens of this country, while, on the contrary, where growing on northern aspects and experiencing a greater intensity of frost they were uninjured.

These are facts, exemplifications of which we can witness every spring, in a more or less degree, in the gardens of this country.

Early flowering hardy plants are of no use as a general rule in our gardens. Wet, winds, and frost will not associate with bright and fragile corollas. The two are incongruous and incompatible. Plants which bloom in the open air before May have little chance of expanding their flowers. But of blooming plants I did not intend to take cognizance in this paper further than as illustrative of the principle which I intended to elucidate, though it will be obvious that they come into the category of spring tender plants. To ornamental evergreens, such as Coniferæ, I intended these remarks especially to apply.

An uniform temperature would be almost as injurious, though in a different manner, to vegetable life as an excessively fluctuating one. But so long as plants are not unduly excited, and then as unduly retarded or checked, much damage will not accrue. It is the alternate exciting by the influence of spring suns and the antagonistic check by the frosts at night which produces the disastrous results, and renders plants spring-tender. To counteract these injurious effects such hardy plants as are known to be highly excitable should be planted in such a situation as will remove them as much as possible from the influences which induce such excitability, for by removing or combating the cause you of course prevent in an equal ratio the results. Many plants are only spring-tender during the early years of their growth, and when having reached four or five feet of altitude evince no susceptibility to their influence. Abies cephalonica is a remarkable instance of this. Within a few days I have examined some of the earliest introduced plants, which for several years after being planted scarcely progressed at all, being invariably much damaged by spring frosts. The fact of their progressing very slowly is evident enough when the lower branches are examined. They are now as luxuriant and as spring-hardy as could be desired.

The comparative hardiness of the same species in various districts is apparently of a very anomalous character, and cannot be explained otherwise than by attributing it to the influence of

local causes; but, from the facts which may be gleaned from an investigation of the subject, there can be no question that many plants, which in various localities are spring-tender, might be rendered otherwise in the same districts. Many which occupy warm, sunny situations, open to the southern aspect, should have been removed from the influence of the early sun altogether, especially in their young state. It is not so much the action of the frost *alone* on vegetable life that causes injury, as the rapid reaction of the frozen parts by the stimulating influence of the sunbeams. A frozen vegetable, allowed to thaw *gradually* in a suppressed light, may escape uninjured, while one submitted to the same intensity of cold, and then in that state brought into a bright light and corresponding warmth, will wholly perish. The animal economy presents corresponding phenomena.

That plants may be, and very often are, "killed with kindness," to use a homely phrase, there can be no doubt. Such as are known to be tender are often, without attempting to ascertain the kind of tenderness which they exhibit, placed in the warmest and most favourable position. Such would of course in many instances be advisable, in others destruction to the plant would follow. Discrimination must be exercised. A little wholesome severity is often found as useful to a plant as to an animal when its future career is taken into consideration, and forms an object of solicitude.

This subject might be much enlarged upon: other points for discussion I shall defer till some future opportunity.

X.—*Dr. Schleiden's Theory of Agriculture.* By the Rev. M. J. Berkeley, M.A., F.L.S.

[Continued from p. 46.]

In considering the objects of cultivation two opposite questions arise for our solution—the one theoretic and the other practical. The first is how to attain with every special exertion no more than one single end and to act upon one condition only of vegetable life. In so doing we should be in a position to measure exactly the degree of that exertion, and consequently to bring it into perfect unison with the end to be effected. This ideal perfection may and should be our aim in every trial and experiment, and the more we advance towards it the surer shall we be of a useful result.

The other is the practical. The object here is to supply the wants of man as abundantly and at as cheap a rate as possible,

and therefore through one and the same effort to satisfy as many conditions as possible, the evil consequence of which is, that the multitude of ends to which it is directed, from the unequal degree in which every particular object is attained, make it extremely difficult to estimate beforehand the results of our labours, so that it requires great knowledge and circumspection to place them in their due relation with the preceding operations.

All, then, that can be done in the present state of things is to examine such methods of cultivation as have from time to time been adopted empirically, and consider on what conditions of vegetable life they operate, which they improve and which they vitiate ; and to this end we have first to review briefly the individual circumstances on which success depends, and secondly, on how many of these conditions, in what way and to what degree, every particular method of culture has any influence.

The circumstances on which the success of agriculture depends may be divided into two classes, those over which the skill of man has no control, and those which he is able more or less to modify. The first comprises climate, atmospheric conditions, and the geologic nature of the substratum ; the latter the physical nature of the soil itself and its chemical constitution.

I.—A. The dependence of vegetation on climate is too palpable to be denied, and yet the cultivator has but little, except his own tact and common sense, to assist him. In countries where there is such an amazing difference between different years, careful and conscientious records of the course of seasons, with the help of a little physiological and geological knowledge, would throw great light on the value of an estate and its capabilities. In Germany there is sometimes all the luxuriance of a subtropical country, while in other years the produce is almost nominal.

The further we go towards the equator or pole the more uniform is the climate and the fewer the species under cultivation. In consequence of the irregularities peculiar to the more temperate regions, a greater diversity of objects and modes of cultivation is possible and indeed necessary, and therefore more skill requisite.

Mere prognostics of weather are worse than fallacious. Careful observers may indeed in their own particular districts look forward safely from past experience to the state of the weather for a day or two, but beyond this there is not even any tolerable degree of probability in their predictions. That there are, however, certain cycles of seasons is far from improbable, but these can only be ascertained by careful and honest registration through a long series of years.

If, however, we could know beforehand that in ten throws of

the dice there would be triplets three times, a high number five times, and a low number twice, bets might be so arranged as to make them on the whole successful; and so in the long run the cultivator might so proportion his crops as to be sure of the eventual result in a determinate course of years, supposing that he had any knowledge on which he could rely of the cycles of weather.

It may be perhaps worthy of remark that though man is unable to exercise any influence on climate in general, he has the power of modifying it in particular localities. Tacitus tells us that no cherries, and much less grapes, would ripen in Germany, speaking of the southern districts and those bordering on the Rhine; and yet the present condition of those districts, arising in great measure from the destruction of forests, is too well known to need any comment. The consequence of any extensive reduction of woodland tends to elevate the temperature, but the results are not all so beneficial. The drying up of springs, the diminution of rivers, and on the other hand sudden and destructive floods, are all notorious consequences. Hence the East, once so richly peopled and cultivated, has half become a wilderness, and hence the dry and barren summers of Greece and Italy, in consequence of which the cultivation of clover, which was once so rich, has become almost impossible; and to this cause are attributable the dreadful floods which almost every year desolate the banks of the Rhone. More examples might easily be adduced, but these are sufficient to confirm the earnest advice, "spare the forests, especially those which contain the sources of your streams, for your own sakes, but more especially for that of your children and grandchildren."

B. Plants which are fixed into the soil by means of their roots, and whose leaves are expanded to the air, may be considered as the children of both. Since the proceeds of all decomposition of organic matter are volatile, the atmosphere may be regarded as the great storehouse of the organic nutriment of plants, as also for water, carbonic acid, ammonia, sulphuretted hydrogen, and perhaps also phosphuretted hydrogen; not, however, as was stated in the former part of this notice, that they are immediately received from the air, but rather through the intervention of water from the ground. Indeed the ground, by reason of every porous body which it contains, absorbs these elements. The relations of the water contained in the atmosphere to the soil are most important as regards vegetable life. If a series of dry summers be compared with the corresponding produce, a great difference will be found to arise from the nature of the prevalent winds. Drought is not so much felt with a course of south or south-west wind as with one of north or north-

east. Plants receive a far greater quantity of water from the steam of the atmosphere than from what falls in the shape of rain, which indeed is especially valuable as an indication of the complete saturation of the air with water.

The coast of Peru affords a most striking example. The soil for eighteen degrees of latitude is a loose moveable sand. From May, for six months, a thin veil of clouds covers the coasts from nine or ten o'clock in the morning to three in the afternoon. From the first appearance of the cloud the sand hills, as if by enchantment, assume the features of a beautiful garden, and support for half a year a vast quantity of beasts and horses, though real rain scarcely falls once in five years.

It has been supposed that rain brings down a certain quantity of inorganic salts, which have even been estimated at 86 lbs. per acre. Half, however, of the water sinks into the depths of the earth to supply the springs, or runs off at once into the streams; and it carries off with it not only a great quantity of soluble salts, but also of inorganic matter: and supposing that so much as 86 lbs. are actually added every year to the soil, and half the water be carried off as above mentioned, each lb. of which contains only five grains of salts, 400 lbs. more of soluble matter would be carried off annually than it receives.

Annual plants, as soon as their seeds are well formed, seem to be perfectly independent of any further supply of water; thus, for instance, the stem of cereals dies from below upwards long before the grains have attained their full chemical evolution.

The motion and pressure of the atmosphere, again, are of great consequence as regards the process of exhalation and evolution of gaseous matter, which could not take place in an atmosphere completely saturated with moisture.

One of the most important points, however, is temperature. Though no tabular observations exist in reference to the subject, it is quite certain that a particular degree of temperature is necessary for the perfect development of each particular plant during every portion of its existence; and were we in possession of good observations we should often be in a condition, from antecedent circumstances of temperature in particular stages of growth, to predict the final result. The vine, for instance, will grow vigorously where, from want of sufficient temperature, neither blossom nor fruit often come to perfection. It is obvious that evils, when foreseen in good time, often cease to be evils.

Light, again, has a very powerful influence on vegetation. The luxuriance of many tropical climes, and the peculiarities of vegetation in Alpine plants, depend greatly on the intensity of the light. The development of the minute fungi which cause mouldiness, on the contrary, is almost stopped by the same

cause. Many mosses and liverworts can be brought to fructify under cultivation only when covered with green glass, which imitates the peculiar light of the places in which they naturally grow.

Electricity, beyond doubt, is a powerful agent in vegetation, but at present we are not in a condition to estimate its influence. The luxuriance of growth after a thunderstorm is well known to be such as the mere quantity of rain which descends is not at all sufficient to explain.

C. The geological nature of the subsoil was the third point mentioned.

With respect to site, a gentle slope towards the south-west is the most preferable, except in very thin, dry soils, and the lower the land lies the more probability is there of accessions of inorganic matter from above. A too rapid inclination causes the water to run off too rapidly, often to the destruction of the soil. Under these circumstances, however, the want of a pervious substratum may be less felt; and even where it is rocky, the shallowness of mould, other circumstances being favourable, may be compensated, and the cultivation of deep-rooting plants be possible. The mechanical composition of the substratum is also of great import. Firm rocks, and difficult of decomposition, present an absolute impediment to any penetration beyond the external soil. Coarse masses of gravel or rubble, which have no power of imbibing the substances lixiviated from the soil and in turn of restoring them when needful, are equally injurious. The most profitable subsoil is afforded by alluvial or diluvial strata of sand, clay, marl, &c., but of these the worst is sand, unless constantly moist from lying at a sufficient depth. The great advantage of these substrata is, that tillage may be carried to any depth, and next in order come such strata as consist of stone, which is loose and easily decomposed. Nor is its chemical nature of less consequence. On this depends the richness of the soil in inorganic constituents, and those subsoils which the more easily part with these constituents are the most favourable, such as volcanic ashes, lava, and basalt; after which come feldspathic porphyry and granite. Pure sand and lime, free from admixture of clay, are the poorest. Those strata also which crop out and whose fractured ends are exposed are better than those where the surface follows exactly their dip. In fact, on the subsoil in great measure depends the just degree of drainage, temperature, and other circumstances, and in general the looser the soil itself is, the firmer and more compact should be the substratum.

II. There are, however, other circumstances which are more or less under the power of the cultivator and on which success immediately depends. He can form a soil where none is present,

and with few exceptions can modify it in all its peculiarities. Each circumstance must, nevertheless, be carefully distinguished in the inquiry and its especial influence noted. The matter may be considered under two heads, the physical and chemical properties of the ground.

A. *a*. The quantity and state of aggregation first require notice. Other points being equal, the most favourable circumstance in soil is its depth. Some of the virgin forests of America, without any manure and with scarcely any labour, will yield abundant crops of tobacco for centuries. The mean depth of soil, however, in our fields is about 6 inches, but the only limit to improvement in this respect is a substratum of hard stone or untractable water. Some plants require a much deeper soil than others. The white mountain clover, for instance, and sainfoin succeed best in a shallow soil, lucern and common clover in deep layers. Plants with spreading roots never grow so thick as those whose roots run deep, and these, when compelled to expand their roots in wet ground, require more room, consequently seed may be sown thicker in deep than in shallow soils. The deeper the soil is, the more independent of course it is of the subsoil. In the southern States of America, for instance, as also in many parts of Hungary, it is so deep as to make the nature of the substrata quite indifferent. The composition of the soil, however, apart from chemical considerations, is equally important. Deep sands like those about Berlin, which sometimes are carried off together with the whole crop which they sustain, and plastic clays which are turned by the heat of summer into stone, are the extremes. Between these there are innumerable gradations, varying in the degree of fineness and looseness, of very different value in proportion as they are sufficiently retentive to allow of no waste of chemical matters, and loose enough to permit the free penetration of the rootlets.

b. The capabilities of soil, as regards temperature, is the next point to be considered. According to Schubler, the temperature depends very little on its chemical constituents, but principally on its colour, and on the moisture it contains. The darker it is, the higher in general its temperature; consequently vegetable mould has in this respect a very decided influence. Humus, however, is an active agent in point of temperature, not only as regards its colour; its loose structure continually saturated with oxygen favours extremely the process of decomposition of the organic substances in the soil; or in other words, a continued combustion which must elicit a quantity of heat equivalent to the results of combustion. How important this is will appear from the following consideration:—If we assume the depth of very good soil, and rich in humus, to be eight inches, there will

be rather more than two millions of pounds to the acre; according to Saussure, $8\frac{1}{3}$ per cent. will be consumed by combustion in a year, that is more than 160,000 lbs.; a consumption capable of raising the temperature of the water contained in the soil 3° of Réaumur. As regards moisture, the ground is less susceptible of warmth the more evaporable water it contains, since the evaporating fluid consumes the heat which is present in the process of the formation of steam. If, in addition, it has a pale light colour, it is almost incapable of receiving heat.

The actual temperature of the soil is in an inverse proportion with its susceptibility of heat. Since a body, on an average, radiates heat the more readily it receives it, there may be soils which attract heat slowly, and therefore are cooler in summer, but which give off their heat also slowly, and therefore are warmer in winter. We are only speaking however of heat directly received from the sun. There is sometimes an accession of heat independent of the sun, namely from the irrigation of running water. Springs have generally a lower temperature in summer, and a higher in winter, than the surrounding atmosphere. In consequence, the formation of seed in water-meadows must be checked in summer, and vegetation kept up in winter, on which principle their great produce is most easily explained.

c. One of the most important properties of soils is the power with which they imbibe gases. The question here relates principally to those which are most important to vegetation, as carbonic acid and ammonia. Unfortunately, though tables exist relative to the absorption of oxygen, there are none which show how the matter stands with those just mentioned. Oxygen is needed only during germination.

Where, however, no actual chemical combination exists, it appears that, when one kind of gas is powerfully absorbed, another is also powerfully absorbed by the same substance; and, therefore, assuming this to be the case, we may use the existent table for an approximation to the results which may be expected with carbonic acid and ammonia. Now these gases are absorbed by all absorbing substances, and particularly by water, which is of especial consequence to our question, in incomparably greater quantities than oxygen; and we may therefore assume that the same law holds good with reference to the soil. With respect to clay, for instance, it is known that, when heated, it begins again while cooling to receive ammonia from the atmosphere. Many of the constituents of humus have so great an affinity for ammonia that, as for instance crenic and apocrenic acid, they were a long time considered as nitrogenous combinations when we were not in a condition to separate them from ammonia. According to some authorities, humus and humic acid, ulmin

and ulmic acid, especially in a moist state, neutralize twenty or thirty times their volume of carbonic acid or ammonia.

It appears then from the tables above mentioned that pure quartz sand has the smallest, lime and gypsum a medium, clay and humus the highest power of absorbing carbonic acid and ammonia from the atmosphere, on which alone the proportionate fertility of these soils depends.

d. The moisture of the ground is however the medium of these powers. Dew and rain will not by themselves supply the demands of vegetation, and therefore the soil must have the power of absorbing steam from the atmosphere. And this power is in exact accordance with what has just been mentioned with respect to carbonic acid and ammonia. And to this must be added that property of retaining water when absorbed, as well as of absorption.

B. The chemical peculiarities of the soil form the second head under this division. Soil which is capable of producing plants in luxuriance must contain the necessary chemical constituents. It is not immaterial in what combination these exist in the soil, which must also contain many constituents which are not necessary for nutrition, but whose presence and quantity affect the physical qualities of the soil, which are themselves of great moment.

a. Insoluble combinations are of course useless to plants, however rich they may be in the requisite materials. On the other hand, analyses which regard merely what is held in solution, inasmuch as a greater portion is carried off by drainage, are, in great measure, useless. The most important constituents of the soil are those which are gradually rendered soluble by the decomposing influence of water containing carbonic acid and ammonia, and partly also by the oxygen of the atmosphere. Silicates, rich in alkalies, answer these conditions. The most favourable combinations are those in which the requisite inorganic matters are contained in organic substances, which protect them from immediate solution, and still, in consequence of their constant decomposition, part with them as the exigencies of the plants require.

Almost all important inorganic matters are destructive or injurious to plants when concentrated, and therefore they must be carried by the water away from the influence of evaporation, which might concentrate them too much, or at least they should be in such chemical relation to water, that it can contain only a certain quantity, and therefore on evaporation parts with the superfluous quantity in an insoluble state. Plants are not capable of selecting their food. The chemical constituents must, therefore, exist in the proper proportion. In uncultivated soils, where the proportions necessary to a particular plant do not

exist, or where they are exceeded, the species will not grow; and in the case of cultivated plants, certain conditions are necessary for the perfect success of each species or variety. It is possible that different conditions may be requisite or desirable at different stages of growth, a point which requires attentive study, as also in what order and in what quantities the constituents of organic materials become free under the influence of weather or decay, and thirdly, in what proportion, at different periods of the year, and in different stages of vegetation, such dissolution and decay take place.

If vegetable mould cannot be regarded as the actual nutriment of plants, with reference to their organic constituents, yet some of its constituents are probably not without importance for the supply of their inorganic elements. Besides that many salts are changed when in contact with decaying humus into easily soluble carbonates or more salutary to vegetation, there are two acids contained in humus, the crenic and apocrenic, which, through their remarkable properties, are in a condition to supply a great quantity of inorganic matter to plants, without, at the same time, overwhelming them with a great mass of organic substance. Both acids are pluribasic; the apocrenic, for instance, is 5 basic, that is, it contains 1 equivalent of acid, and 5 of the base; therefore double and triple salts are easily formed; and if but one equivalent of ammonia be present, the salts are easily soluble.

It must be remembered, that this condition must be reversed, if the organic substances of the ground were really destined for the organic nourishment of plants.

b. The physical nature of the soil must be in a proper relation to its chemical constituents. Sand, lime, clay, and humus are the elements of the question. These, if properly proportioned, will satisfy the necessary conditions of vegetation. About 40 or 50 per cent. of clay seems the best proportion. A greater quantity makes the ground too stiff, and also, from its retention of water, too cold. With less than 10 per cent. it will be too light or poor. Humus is here, however, of the greatest moment. Its very loose consistence acts with extraordinary rapidity on the texture of clay, while its attraction and retention of water serve in the most wonderful degree to bind sand together, as appears from the fertility of the red soil of Cuba, which is naturally free from humus, and the Brazilian and North American forests, which consist of nothing else; so that, under favourable circumstances, clay may replace humus, and humus clay. The following table shows, in the most striking way, that the fertility of soil is proportionally quite independent of the humus which it contains:—

Nature of Soil.	Humus contained.
Soil on which rape-seed is cultivated near Lille . .	0·0 per cent.
Very good English turnip-land	0·6 ,,
Sandy ground covered with fine pines in the Black Forest	1 3 ,,
Extremely fertile wheat-land in England	2·8 ,,
Vineyard of Rotheberg in Rheingau	3·3 ,,
Barren sands near Göttingen	4·2 ,,
Very good English wheat-land	4·4 ,,
Barren clays of Lüneburgh	4·4 ,,
Good meadow-land in Bebenhausen	4·5 ,,
Fertile ploughed land near Göttingen	5·0 ,,
Very light soil, unfavourable for common culture, Neckarthal	8·4 ,,
Best English meadows	12·7 ,,
Black barren moors	76·0 ,,
Very light barren brown peat	89·0 ,,

It appears then, from all that has been stated, that in order to insure favourable results, attention must be turned first to a thorough knowledge of the particular objects of cultivation, their climatic conditions, the soil they require, the differences which exist between them and plants in free nature, the properties of soil, as well in those points over which man has no control, as the state of its texture and composition, which are more or less within his power. This leads to the subject of fallowing, then to various modes of working the land, to manures, to drainage, and finally to rotation of cropping. Some of these have already occupied so much room that they must be passed over in a few words.

A. Under the first head we shall content ourselves with pointing out the necessity of embracing every opportunity of improving the objects of cultivation. Wherever any peculiar qualities exist in a particular plant, especially adapted to any particular soil, that plant should be carefully preserved, and every circumstance about it noted. Those who cultivate on a large scale, and extensive proprietors, may thus in process of time acquire valuable varieties or information as to the points which have produced any especial good qualities, to the great benefit of society. But in cultivation on a small scale, much depends on a cautious selection of seed. It should be perfectly ripe, clean, and free from admixture of weeds, and care should be taken that it was grown upon a suitable soil. That which comes from a barren field is much more likely to be true to its variety than what comes from highly manured land. In general, the time of sowing depends upon circumstances which place it out of the power of the cultivator to choose his weather; rye and barley, however, require a drier time than oats.

B. As regards the knowledge of the soil, this must be obtained by actual examination, though not by a perfect chemical analysis. No certain judgment can be formed by its natural produce, but

an inspection of its physical condition and general chemical constituents, such as may be made by simple mechanical processes and a slight degree of chemical manipulation, which will give not only a notion of its present worth, but of its future capabilities, is almost indispensable.

C. The object of ploughing, and other allied processes, is the deepening of the soil, the alteration of its texture, either by the mere mechanical action or admixture of organic and inorganic manure, and the destruction of noxious weeds, to which may be added the necessity of placing the seed in a fit position for vegetation, and protecting it from birds and other noxious animals. It must be borne in mind that, while the opening of the soil subjects it to the influence of the atmosphere more completely and to a greater depth than would be otherwise possible, the humus is rendered liable to rapid decomposition, such as may more than overbalance any good which might arise from the exposure of the surface; and this destruction takes place at the very time when it is not available for the demands of vegetation, added to which the most valuable portions are often carried off by an overflow of water. Ploughing, then, must be considered rather as a necessary evil, and one to be employed only so far as necessity requires. Because frequent ploughing is useful in some cases, it is not to be assumed hastily that the rule is generally applicable.

D. The doctrine of fallows will require a rather more copious abstract. The word was originally applied simply to land which was left uncropped, and may be considered exactly opposite to the employment of manure. Afterwards the system was somewhat complicated by the introduction during the last century of leguminous plants, such as clover, especially from Italy, where the system had long been practised, and fallows, in the old sense of the word, have in great measure become obsolete, though it was long retained for matters with which it was originally entirely unconnected.

We may define it as follows: Fallow is that condition of the land in which, during one or more years, nothing is taken away in the shape of harvest, or added in that of manure. In this strict sense the grazing of cattle on the fallow-field would be excluded, but, inasmuch as through grazing there is so little infringement on the proper purport of fallow, it is included under our notion of the word.

Fallows may be divided into green and naked fallows: in the first the land is suffered to clothe itself with a thick coat of weeds; in the second it is kept bare by one or more ploughings, so as to be constantly exposed to the influence of the atmosphere.

1. The thick covering of soil with vegetation hinders in many ways the action of the atmosphere upon it. The shading of the

leaves keeps off the direct sunbeams, and consequently impedes evaporation. The moisture is therefore retained for the exigencies of the plants, which are consequently more luxuriant, as also from the increased absorption of carbonic acid; while the consumption of humus is either prevented or prolonged from the stagnation of the air immediately in contact with it, since an atmosphere of carbonic acid, the produce of decomposition, surrounds the constituents of the humus, impeding the accession of fresh oxygen, and consequently of further decay. Those parts meanwhile which are slowly dissolved are stored up in the plants which cover the ground, which constantly receives an addition from the falling leaves, and the accession of vegetable matter is eventually greatly increased by the ploughing in of the green covering. The benefit of such fallows to poor and light ground is at once evident.

2. In the naked fallow, weeds are not allowed to come to their full growth. The increase of humus is therefore slight from this source, while it is sensibly diminished by the constant ploughing, the dissolution of its mineral constituents proceeding with equal rapidity. These unfortunately are subject to be washed away by overwhelming rains. The naked fallow is only useful then where the requisite looseness of soil cannot be attained in any other way.

The notion of rest so prevalent amongst cultivators is clearly wrong, except it be rest from the destructive influence of the plough.

E. The subject of manures has already been touched upon so much that we must content ourselves with some general remarks, without entering upon any special substances, which are treated at considerable length by Dr. Schleiden. There is the less need to follow all his observations, as much is accessible to English readers in the work of Boussingault.

The word manure, taken in its widest sense, comprehends everything that is put to the land with a view to the improvement of the crop, whether organic or inorganic. No agricultural operation can satisfy one condition alone of vegetable life. It is by manure almost exclusively that man is able to alter the character of land, and the supply of nutriment from it is so far from being the only object it answers, that in many cases it might be doubted even whether this were the principal end, and therefore the individual properties must be separated carefully from one another.

If we consider the waste which takes place in the consumption of what is carried out of the field, that in such crops as flax scarcely anything is returned, that a large portion of the organic matter is destroyed by the process of combustion, it will be evident that, without having recourse to fallows or green cropping, it would be impossible to cultivate land with mere farm-

yard manure, and that the organic matters can be merely accessories, and not the most important principles.

It must be remembered, too, that the animal world depends ultimately for its existence on the vegetable kingdom, and therefore what animals require for nourishment must be necessary and not accidental constituents of plants. Mammalia want, for instance, lime and phosphates for their bones, iron for the colouring matter of their blood, nitre for their bile, muriates for their gastric juice, and probably they could not live without potash and sulphur, which we find in all their fluids. These then of necessity must enter into their composition, and in grasses flint is indispensable, though we do not find that it exercises any important function in animals. This latter principle is universally diffused, while phosphates are comparatively rare, and therefore demand the first consideration. They exist in animal manure, especially in human ordure, combined with lime, magnesia, and ammonia in a soluble or insoluble form, and are supplied largely by bones, which in England are imported extensively from the Continent.

There are many tables which seem to indicate that manures are profitable in proportion as they are rich in nitrogen; but the experiments from which they were derived were made under prejudiced views, and they show that their beneficial character is at least as clearly indicated by their alkalies and phosphates, as appears by the tables of Hermbstädt and Kuhlmann. Alkalies are very generally diffused in nature, though there are lands almost destitute of them which require a proper admixture. These besides generally form highly soluble combinations which are easily carried away by water, and the plants which grow in the neighbourhood of dung-hills and farm-yards are especially those whose ashes abound in them. A great waste, therefore, must occur, which ought to be carefully replaced. Chili saltpetre, a natural nitrate of soda, has been much recommended. That the alkali, and not the nitrogen, is the active principle here appears from the fact that the increase in hay and straw from manure with nitrate of soda contains twice as much nitrogen as the salt used for manure. Lime is a very general principle, and as the carbonate and sulphate are not very soluble a good deal remains in dung; still there is waste, and some kinds of land are naturally deficient in this principle. Marl and gypsum are the great sources from which it can be artificially supplied; the latter also affords sulphur. Iron, magnesia, sulphuric acid, and muriatic acid may be classed together, because they are of less importance than the others, and need no particular observations. Magnesia, though present in small quantities, seems to have an important office (perhaps from its relation to phosphoric acid); at least, it is surprising that in the ashes of most plants it bears a greater proportion to lime than it does in the soil.

Flint is so universal that, however necessary, it scarcely ever requires to be supplied artificially, and if so the point would be to apply it in a soluble form. It must be remembered that the greater part of the silex comes back to the land with the manure, while a proportionately large quantity of the more valuable constituents is carried off with the grain, a circumstance of great consequence in estimates of cropping and manure, as the relative proportions on which so much depends are totally deranged.

It does not follow, though under certain methods of farming more inorganic matter comes back continually than has been taken away, that inorganic matters are not the important constituents in the nutriment of plants, because, if the alkalies in the harvest be as 2·3, and that in the manure as 2·17, or on the addition of turf ashes, as practised by Boussingault, as 2·30, the conditions are altogether different, a fact which seems to be too often overlooked.

A very few words on organic manures must suffice, as so much has already been said on the subject. Nitrogen is received from dung in the form of ammonia. It is a common notion that the proportion of ammonia contained in manure is of great value as regards the nourishment of plants, which is sometimes regarded as the only source from whence the nitrogen contained in plants is derived. The great produce of water-meadows, which receive no dung, is sufficient to show that this prejudice is not well founded. Peruvian guano containing 29·88 lbs. of nitrogen has almost the same effect as bone-jelly containing 82·55, and one-third more than sulphate of ammonia containing 50·75. The substances which have most effect as manures are those which are rich in phosphates, and in a series of experiments the greatest effect was produced by Flemish dung, consisting of urine and pure human excrement, which is rich in alkalies; and that these ought to be taken into consideration is proved by the favourable effects of Chili saltpetre (nitrate of soda). It is remarkable too that bone-ashes, rich in phosphate of lime, produce no effect by themselves, but, when combined with ammoniacal water from gas-works, their effect is surprising, a result which probably depends on the dissolving power of the ammonia on other substances, and especially on phosphates.

On the whole then it appears that, except in cases of an inexhaustible depth of soil, cultivation cannot succeed, or at least the fertility of the land be fully sustained, from the resources of the soil itself; either a portion must be in meadow, or additional manure must in some shape or other be introduced.

B. Manures act also on the physical constitution of the ground. The power of absorbing steam and gas from the atmosphere depends almost exclusively on the quantity of clay or humus. The great point undoubtedly is to keep up the supply of the

latter, to produce which is the great office of the organic matter in manure. The manure, however, made upon a farm will not suffice for this, without there is a proper proportion of meadow or of artificial grasses. Other physical conditions, as temperature, looseness of soil, are also promoted by this substance, which however on strong clays may, to a certain extent, be replaced with sand, and on loose sands with clay, where it is profitable to do so.

C. The regulation of water or draining is absolutely indispensable for good cultivation, while, on the other hand, the freest irrigation is of immense advantage. The difference arises from the state in which the water is which comes in contact with the roots of the plants. The poorest vegetation exists in moors and peatbogs, which are constantly saturated, while the richest is found in alpine meadows constantly irrigated. The difference is, that in the one case the water is stagnant, and in the other constantly changed. Plants require but little sulphur, and consequently sulphuretted hydrogen, supposing that they receive their sulphur in this form. Sulphates in contact with decaying organic substances soon unite with them, and thus sulphuretted hydrogen is generated in such quantities as to be destructive to many plants.

D. A few remarks on rotation of cropping must close our abstract.

Experience has shown that fallows may be in a great measure dispensed with by a system of rotation, including clover. The object of science is to show in what way this is explained by the nature of plants, and inasmuch as improvement is impossible, or at least accidental, without knowledge, such inquiries have their practical side. It is on the cultivation of clover that the main advantage of rotation depends, the object of it being to increase the quantity of humus; and it is to be observed that in the published tables a very important part of the accession derived by the field is neglected, namely, that from the leaves which are constantly withering and falling off, which amount perhaps to twice or thrice as much as what is carried away.

Wheat, like other cereals and grasses, will succeed without humus, provided the requisite moisture be kept up, but where this is not possible there must be either a very favourable clay, or the ground must be very rich in humus; but, in consequence of their thin leaves and slender hollow stem, they cannot take up a great quantity of moisture at once in anticipation of a dry time, and therefore they require an uninterrupted supply of moisture, which must be afforded by absorption from the atmosphere by means either of the clay or vegetable mould.

There are two points to be distinguished with respect to rotation. First, it may be regarded as a whole, as a method of cultivation by which clover takes the place of fallow, and by which a greater produce of cereals is possible; and this leads to the

cultivation of other plants, so that a greater number enters into the question. Hence a second subject of inquiry, in what order ought these to succeed each other?

The first question needs no further observation. The second is unfortunately one of great difficulty, for the solution of which but few data exist at present. Experience informs us that two crops of a similar nature should not succeed each other, and science at present can do no more. The matter of greatest consequence will always be with what plant to begin the course. Inorganic matters ought not only to be present in the soil, but in the right proportion. The worst method then should seem to be to begin with the potato, the contrary practice for so many years being probably one of the main causes of the present depraved state of the plant. The choice must be directed by a comparison of the inorganic constituents of the dung with those of the plant proposed, so that that plant will be taken first which on analysis bears the nearest proportion to that exhibited by the manure. If then the inorganic contents of the harvest be subtracted from those of the manure, the second plant will be chosen according to its relative proportions, and so on through the whole of the course. Now, if we compare the contents of ordinary manures with those of agricultural plants, we shall find that potatoes and wheat are those which have the most distant relation. They are those which are subject to most diseases. If the comparison be continued, and attention be paid to the proportion of the most influential constituents, namely, the phosphate of lime and magnesia to the sulphuretted and muriated alkalies, we obtain the result that of all plants rye is the best with which to begin the course, which agrees with the opinion of many practical men, that rye is most suited to fresh manure.

It must, however, be taken into consideration, that in rotation of cropping changes in the physical condition of the ground are effected which are of as much consequence as the proportion of the inorganic constituents, so that the choice is much contracted, and comes indeed to a question between cereals and other agricultural plants.

The above attempt to give a fair and useful abstract of a work certainly entitled to consideration will, it is hoped, be suggestive of much that is valuable, and throw light on some points on which a great deal of confusion exists at present. The almost total absence of reference has made it occasionally a matter of some difficulty to arrive at the exact meaning of the author. It must be borne in mind that the argument proceeds on a system of cultivation not altogether coincident with what we are ourselves accustomed to, and that consequently a little allowance on that score must sometimes be made.

XI.—*On the Effect of Glazed Trellises for Peaches.* By Robert Thompson.

In September, 1850, it was reported that some peaches laid before the Garden Committee had been grown on a glazed trellis, put up exactly according to a plan recommended by Henry Bellenden Ker, Esq., and Mr. Rivers. The peaches were ripe next the sun, but their under sides were hard. This produce could not, however, be considered to afford conclusive evidence, as it was that of the first year after planting; and in this operation it was necessary to reverse the trees, otherwise they could not have been fixed to the trellis. The blossom buds previously formed towards the sun were turned downwards.

It was afterwards suggested by Mr. Rivers that the sashes should be brought nearer the trellis: this was accordingly done. The sides were also banked up, so as to leave a clear opening of only 3 inches along the north, east, and west sides, whilst a sheet of perforated blackened zinc was extended from the ground to the sashes along the whole of the south side. Under these arrangements the experiment was continued during the season of 1851.

By this time the trees were well established, healthy, and in condition to bear a good crop of fruit. The spring was unfavourable; and although the sashes would doubtless be sufficient protection for the blossom against slight frosts, yet it may be useful to state the fact, that these sashes did not sufficiently protect the blossoms when 7° of frost occurred last April, and that moreover the blossoms under the sashes suffered more than those against the open south wall.

In September, 1851, some peaches grown on the glazed trellis were again exhibited to the Garden Committee. They were red, and their skins beginning to crack from over-ripeness, next the sun, a proof that they were well exposed; but the under sides were hard and green, and had not swelled equal to the sunned sides. The nights of last summer were often unusually cold and unfavourable to the experiment; and if the openings round the frame had been closed, or nearly so, during these cold nights, the thorough ripening would have been greatly assisted. But this would have assimilated the glazed frame to a peach-house, and all fair comparison between it and the open wall must have ended. On the latter the same sort of peach ripened thoroughly at least ten days before that in the frame ripened partially. From this the result of the experiment may be fairly estimated, and the plan certainly cannot be recommended.

REPORT FROM THE COUNCIL

TO THE

ANNIVERSARY MEETING, MAY 1, 1852.

AT the last Anniversary the Council had to report that the debt of the Society had been increased to the extent of 111*l.* 6*s.* 7*d.* in consequence of improvements in the Garden, which had cost 1044*l.* 3*s.* 2*d.* It is now their pleasing duty to announce that the debt has been reduced within the year by the sum of 859*l.* 0*s.* 1*d.*, notwithstanding a further expenditure upon new works to the extent of 360*l.* 2*s.* 3*d.*, and a less favourable Exhibition season than was anticipated; and the Council confidently believe that this has been effected without neglecting the progressive improvement of the Society's position, or the public objects for which it was incorporated.

To the following statement, which has been laid before the Council on the part of the Garden Committee, the attention of the Meeting is invited in the first place.

The Exhibitions in the Society's Garden have fully maintained their great reputation as examples of the ever increasing skill of English Gardeners in the art of cultivation. The tables, although extended so as to receive a much larger number of plants than formerly, were more crowded than ever with magnificent specimens, among which it was observed that variety was displayed more conspicuously than usual.

The new regulations under which Fellows of the Society and friends are admitted an hour and a half earlier than others, appeared to give much satisfaction, and worked so well that the Council were induced to extend the privilege beyond its original limits; so that now, not only can any Fellow of the Society enter free at half-past 12, and introduce one friend with a ticket, but the privilege may be transferred to a brother, sister, son, daughter, father, mother, or wife, residing in the Fellow's house, provided the person to whom the transfer is made be furnished with a ticket signed by that Fellow. That is to say, the privilege of entering early may be largely transferred, but not the privilege of free admission.

The weather was unfortunately not propitious. In May, a mild and sunny morning was succeeded by a cold wet afternoon. In June the day was dry, but sunless. In July it was wet and uncomfortable. The result was, that the visitors on each of these days were :—

May 3rd	1549
June 7th	9383
July 19th	9345

Had the 3rd of May been a fine day several thousand additional tickets would have been used; even in June the aspect of the weather was so threatening as to deter many from running the risk of a wet promenade; and in July the attractions of Chiswick grounds, again kindly thrown open by his Grace the President, were far less sought for than if the scene had been enlivened by a warm and brilliant sun.

The Tickets actually sold amounted to 23,630, a higher number than has been issued for five years past; but much lower than would have been required had the Meeting in May been as favourable as it was the reverse.

As it is possible that the increased number of visitors in 1851 was in some degree owing to the issue of 48 instead of 24 privileged tickets to each Fellow of the Society who applied for them, the Council have directed the same number to be again allowed during the present season. This is done, however, by way of experiment only, and not as a final regulation, the year 1851 having been so exceptional that no satisfactory opinion upon the effect of an unusually large issue of 3*s*. 6*d*. tickets can be formed in the absence of the evidence to be obtained during a season in which the metropolis is in its usual state.

In a financial point of view the Exhibitions were satisfactory, notwithstanding the unfortunate state of the weather.

The receipts amounted to 5046*l*. 7*s*. 6*d*., arising from the sale of

	£.	*s*.	*d*.
13,405 tickets at 3*s*. 6*d*. . . .	2345	17	6
9,071 ,, at 5*s*.	2267	15	0
1,154 ,, at 7*s*. 6*d*. . .	432	15	0
	£5046	7	6

The expenses on the other hand amounted to 2,178*l*. 11*s*. 6*d*., as is shown by the following return; the profit realized was therefore 2,867*l*. 16*s*.

Exhibitions.	1849			1850			1851		
	£.	s.	d.	£.	s.	d.	£.	s.	d.
Miscellaneous timber	50	18	1	23	10	2	27	3	8
Miscellaneous repairs	65	13	11	60	2	7	39	0	6
Carpenters, painters, tent-pitchers, &c.	146	6	10	126	4	7	121	10	11
Miscellaneous labour beyond the ordinary service of the Garden . . .	255	14	2	188	13	7	69	17	5
Miscellaneous printing	39	8	2	31	13	6	64	17	10
Admission tickets	37	15	0	37	15	0	30	14	0
Advertisements	86	16	0	86	13	6	125	4	6
Judges	27	6	0	30	9	0	31	10	0
Extra clerks and temporary rooms .	54	7	0	28	11	6	22	16	0
Police	112	6	0	60	11	0	81	9	0
Bands and all musical expenses . .	277	2	0	270	6	0	300	0	0
Provisions for exhibitors, police, &c. .	57	2	0	55	10	2	56	0	11
Watering roads	28	5	0	. .			15	15	0
Miscellaneous expenses, including stationery, carriage, postage, &c. . .	66	11	5	54	12	6	48	3	0
Cost of new tents	297	8	9	. .			65	0	0
Green baize for tables	. .			. .			46	3	9
Extra labour for New Exhibitors' Yard and Alterations	. .			52	9	0	. .		
	1603	0	4	1107	2	1	1145	6	6
Medals awarded	984	15	0	1066	5	0	1033*	5	0
	2587	15	4	2173	7	1	2178	11	6

A comparison of this table with some of those of former years shows that the charges have for the most part been diminished, with the exception of advertisements, printing, police, and bands, in which the Great Exhibition of all Nations rendered some increase unavoidable.

In framing the schedule of prizes for the year 1852 the Exhibition Committee have complied with a desire expressed by many exhibitors and others, that greater prominence should be given to certain classes of florists' flowers; the effect of which, it is expected, will be to increase the brilliancy of the shows at the Garden. The Committee have also felt themselves called upon to return to the system of not offering specific prizes for fruit for the month of May; the responsibility of rewarding such as is sent on that occasion being vested in the Judges, who will thus have as complete a freedom of action as if a schedule of prizes were offered, and will at the same time be released from

* This is part of the sum of £1120 entered in the balance sheet as medals awarded; the balance being, for awards at ordinary meetings in Regent Street, 60*l.* 10*s.*, and for cost of new obverse die to large silver medal 26*l.* 5*s.*

the supposed necessity of giving prizes for fruit which does not possess very unusual merit.

In the year 1850 a very strong opinion was expressed that the Garden of the Society ought to contain, during the London season, and especially in 1851, when so many strangers would have an opportunity of witnessing our national tastes, one of those displays of American plants which have lately become so popular. The Council, therefore, felt it to be due to the Fellows and their friends, that the possibility of forming such an exhibition without any serious inroad upon the funds of the Society should be put to the test of experiment. That this was about to take place was mentioned in the last Report. The arrangements then made with Mr. Hosea Waterer were afterwards completed; and a very large number of the finest specimens of Rhododendrons, Azaleas, and other American plants, were exhibited under a canvas awning in a part of the Garden provided for the purpose. But, although the arrangements connected with this operation were formed with the utmost attention to economy, a reference to the balance sheet will show that the experiment was too costly to be repeated. How far it may have added to the interest of the general exhibition in June there are no means of ascertaining; taken by itself it produced a loss of 256*l.* 18*s.* 8*d.*

During the autumn the site of the American exhibition has been converted into a permanent American garden, for the means of planting which the Garden Committee desire to express in the strongest manner their obligations to Messrs. Veitch & Co., of Exeter, who presented the Society with a large number of valuable specimens. They have also to make their acknowledgments to Mr. H. Waterer for several useful contributions, and to Messrs. Lucombe and Pince, of Exeter, whose liberality, in an exchange of plants made with the Garden, demands especial notice. In the purchase of plants, peat earth, and other materials, and in labour, the sum of 155*l.* 9*s.* 7*d.* has been expended, and an American ground is now permanently established in the Society's Garden, thus obviating the necessity of any further outlay upon temporary exhibitions of this description.

While the attention of the Committee was thus directed to relieving the Garden from risks of future loss on account of American plants, they have continued to carry on the other works in the Arboretum and elsewhere, to which allusion was made in the last Report. The number of superfluous trees has been still more diminished, masses of useless bushes have

been removed, walks have been widened, exhausted beds of Rhododendrons and other plants have been replanted and renewed, seats have been constructed within the shade of trees, a better approach, in stone, has been provided to the Great Conservatory, and some winter and spring decoration has been given to most of those beds in the Arboretum which have hitherto been merely occupied by bedding out plants in summer. In aid of this operation Messrs. Osborne and Co. have liberally contributed all the evergreens required for the purpose.

The only building of a permanent character which the Committee have caused to be constructed is a wooden house for the growth of Roses. The experiment of Mr. Rivers upon the cultivation of plants in what he calls Orchard Houses—that is to say, in very cheap glazed wooden sheds—has been attended with so much success, and has excited so much interest among cultivators of limited means, that the Committee felt themselves called upon to place in the Garden an example of this kind of structure. They have therefore built a house 56 feet long and 23 feet wide, entirely with wood and glass, upon a plan furnished by Mr. Rivers, for which the Garden funds are charged with the sum of 66*l.* 4*s.* 7*d.* This house is to be devoted exclusively to the cultivation of Roses, and has been planted at their own charge by Mr. Rivers, of Sawbridgeworth, Messrs. Paul and Co., of Cheshunt, and Messrs. Lane and Co., of Great Berkhampstead, with the finest varieties which those justly eminent firms could supply. The experiment will show the value of the opinions of those who doubt whether plants can be advantageously grown in such buildings. Should the experiment be unsuccessful, the materials of the house can be applied to some other purpose, the sashes having been prepared with the same care as if they had been intended for a more durable structure.

Measures have been also taken to place in the Garden a length of the glass walls patented by Mr. Ewing, and some iron and glass coverings for walls suggested by Colonel Challoner, and executed by Messrs. Cottam and Hallen. These not having been fixed in the Garden at the date of the last meeting of the Garden Committee, the subject must form a part of the next annual Report.

The expense to the Society of the works now alluded to has been as follows :—

	£.	s.	d.
Alterations in Arboretum, &c. . . .	104	8	3
Completion of American garden . . .	155	9	7
Construction of Orchard House for growth of Roses	66	4	7
Miscellaneous expenses in altering and improving the Garden . . .	34	0	3
	£360	2	8

The Distribution department continues to work satisfactorily, the following having been the numbers of plants, &c., given away.

1851–52.	Plants.	Seeds.	Cuttings.
To Members	5,025	46,123	2,257
To Foreign Countries, Correspondents, &c.	302	666	94
To Her Majesty's Colonies	12	952	. .
Total	5,339	47,741	2,351

But although the Committee announce with satisfaction that the value of the articles distributed has very materially improved under the new regulations announced in the last annual Report, they at the same time feel that the period has arrived when it is desirable once more to despatch a collector of plants in search of horticultural novelties. The Council have concurred in this opinion, and it is now seriously under consideration whether an agent may not be advantageously employed in some of the temperate regions of South America. With regard to the Scotch expedition to Oregon, towards the expense of which the Society subscribed in the year 1850, there is still nothing to report, except that it continues to remain without result.

The assistance rendered to the Garden by its correspondents has been unusually large, as will be seen from the following list of presents, in addition to those large supplies from Messrs. Lane, Lucombe and Pince, Osborne, Paul, Rivers, and Veitch, which have been acknowledged in a former part of this Report.

From C. A. Uhde, Esq., of Handschusheim, near Heidelberg, Seeds of the Russian Forget-me-Not, and a purple Potato raised in Germany from the Mexican Potatoes formerly given to the Society by Mr. Uhde.

From Sir Thomas Acland, Bart., a Plant of Escallonia macrantha.

From Redmond Barry, Esq., of Port Phillip, a collection of Seeds from New Holland.

From I. Anderson, Esq., of Edinburgh, Sedum Quitense, Alpinia sp., from Hong Kong, and 4 other plants.

From J. B. Pentland, Esq., a plant of Pœcilochroma sp. (Witheringia superba), Seed of a new species of Cinchona, and a variety of Indian Corn from Titicaca.

From G. U. Skinner, Esq., a Plant of Achimenes Margarettæ, with various Orchids and other newly imported plants.

From Miss Croker, 3 Orchids from Rio.

From Mrs. Le Blanc, 10 sorts of Seeds from Russia.

From G. H. Thwaites, Esq., Superintendent of the Botanic Garden, Ceylon, 12 sorts of Ceylon Seeds, including Medinilla Walkeriæ.

From Capt. Drake, Orchids from the Brazilian Coast.

From Mr. D. Ferguson, Botanic Garden, Belfast, 4 Bulbs of Lilium giganteum.

From the Royal Botanic Gardens, Kew, several new Plants.

From Mr. Charles Moore, Botanic Garden, Sydney, New South Wales, a Wardian Case, containing a new Araucaria (Araucaria Cookii), Calanthe australis, and other valuable Plants.

From Prof. Chas. A. Meyer, Superintendent of the Botanic Garden, St. Petersburg, a collection of curious Botanical Seeds.

From Charles Deacon, Esq., 3 bulbs of a Lily and 14 sorts of Syrian Seeds, with Seeds of the Melon of Cassabar, near Smyrna.

From the Earl of Dundonald, Nutmegs, Tamarinds, and other Plants from the West Indies.

From G. T. Davy, Esq., 5 papers of Jamaica Seeds, Seed of the true Calisaya plant, Tropæolum azureum, Chloræa sp., and some remarkable Maize from Cusco.

From the Museum of Natural History of Paris, a plant of Angræcum virens.

From J. R. Gowen, Esq., Seeds from New Zealand.

From H. C. Calvert, Esq., 2 kinds of Erzeroom Seeds.

From the Honourable Miss Murray, a Plant of Pulmonaria angustifolia.

From the Honourable Court of Directors of the East India Company, some Orchids, with Seeds of Abies Deodara and of two species of Loranthus.

From Captain Prendergast, Bulbs from the Western Coast of Africa.

From W. W. Saunders, Esq., a collection of Alpine Plants.

From J. E. Stocks, Esq., 2 papers of Seeds from Affghanistan.

From J. C. Stevens, Esq., a Plant of Vanda cærulea.

From Mr. Clare, of Como, Plants of the Como Cherry.

From John Reeves, Esq., Seeds of the Egg-Gourd.

From Mr. Watts, Oriental Printing Office, 8 tubers of the Potato which grows wild at Laontong, North of China.

From the Marchioness of Hastings, a Plant of the Rhodian Grape.

From Mr. D. Kidd, a Plant of the Garnstone Black Hamburgh Vine.

From John Edwards, Esq., 47 Plants of the choicest Lancashire Gooseberries.

From Mr. J. Shed Needham, of Massachusetts, a Plant of Needham's White Blackberry.

From John Disney, Esq., Cuttings of the Fifi Apple.

From the Rev. John Robinson, Cuttings of 2 sorts of Apples.

From R. A. Hornby, Esq., a Plant from Conception.

From H. A. Aglionby, Esq., 2 sorts of Potatoes.

From Edward Hay, Esq., of Turnham Green, Seeds of a Green Gourd from Riba, North of Spain.

From Henry Butler, Esq., Seeds of a very superior sort of Olive, grown at Messina.

From M. Vilmorin, of Paris, 26 sorts of Choice Flower Seeds.

From Messrs. Standish and Noble, of Bagshot, 2 Plants of Taxodium sempervirens.

From Mr. Charlwood, of Covent Garden, 11 sorts of New Annuals, and 3 sorts of Indian Corn.

From Messrs. Weeks and Co., Seeds of the Turkey Cassabar Melon, from Constantinople, the Royal Victoria and Royal Albert Melons, Weeks's Hero of Middlesex Cucumber, and New Long White-spined Cucumber.

From Mr. Thomas Rivers, of Sawbridgeworth, Plants of Rivers's Eliza Strawberry.

From Mr. John Salter, of Versailles Nursery, Hammersmith, 3 sorts of new Strawberries.

From Mr. Geo. Wheeler, of Warminster, a Plant of the Bowden Nectarine.

From Mr. Thomas Whalley, of Liverpool, a packet of Early Prince of Wales Pea.

From Messrs. Hay, Sangster, and Co., a bag of Potatoes said to have been obtained from cuttings; a root of the Prince of Wales Early Scarlet Rhubarb, 3 sorts of Early Potatoes, and Sangster's No. 1 Early Pea.

From Messrs. Veitch and Son, of Exeter, Lilium giganteum, Cantua dependens, and 10 other new Plants.

From Mr. Glendinning, of Chiswick Nursery, Neillia thyrsiflora, and a new species of Clianthus.

From Mr. R. T. Pince, of Exeter, Pentstemon cyananthus, Cattleya superba, and Oncidium barbatum.

From M. Jamin, of Paris, Buds of 7 sorts of Pears, 4 sorts of Peaches, and 2 new sorts of Strawberries.

From Mr. J. A. Henderson, of Pine Apple Place, a Plant of Judson's Richmond Villa Black Hamburgh Vine.

From Messrs. Jackson, of Kingston, 6 sorts of Kitchen Garden Seeds.

From Messrs. Dickson, of Chester, Seeds of 2 new sorts of Cabbage Lettuce.

From Messrs. Rendle, of Plymouth, new sorts of Kitchen Garden Seeds.

From M. Baumann, Deutzia gracilis and a species of Tropæolum.

From Messrs. Wrench, of London Bridge, a collection of Californian Seeds.

From Mr. Hosea Waterer, Thuja aurea and the Yellow-berried Yew.

The Reading-room continues to be a source of satisfaction to the Committee, the use made of it by the young men in the Garden being unremitted; and they trust the advantage of it very considerable. In aid of the studies in it a course of lessons in mensuration and plane drawing has been added to the lectures volunteered by the Vice-Secretary and his friends. The library now consists of about 500 volumes, but it might be increased with advantage if Fellows of the Society, interested in the education of young gardeners, would lay aside for the library any

books on horticulture or allied subjects for which they have not themselves any use.

The number of Visitors to the Garden has not materially increased, notwithstanding the unusual influx of foreigners, the total admissions, exclusive of the days of exhibition, having been 6964, rather more than 200 above the number in 1850-51.

The only other point to which the Committee would allude is the general expenditure of the Garden, the details of which for the last three years are given in the following table.

	1849–50			1850–51			1851–52		
	£.	s.	d.	£.	s.	d.	£.	s.	d.
Garden labour	1010	15	0	1077	19	6	1332	1	9
Implements, mats, seeds, &c.	113	15	5	116	8	10	118	8	6
Tan, dung, &c.	28	6	1	50	1	11	31	11	9
Coals and coke for Garden	147	16	1	129	0	7	96	13	9
Miscellaneous expenses at Garden	183	13	2	140	3	5	127	16	4
Garden repairs	107	6	11	92	12	5	109	5	3
Distribution expenses	214	13	8	170	15	1	124	15	1
Exhibition expenses	1562	10	10	1107	2	1	1145	6	6
New works at Garden	231	18	1	1044	3	2	360	2	8
American Exhibition expenses, 1851	..			..			275	5	8
Total	3600	15	3	3928	7	0	3721	7	3

The chief item which appears to require explanation in this account is the charge for labour, which would seem to have largely increased, although in reality that is not the case. It will be remembered that at the last anniversary it was announced that various changes had been made in the management of the labour; that permanent mowers had been substituted for the desultory system previously in force; that the lawn in the Arboretum would be no longer allowed to grow rough in autumn and winter; that the distribution department had been altered, and a small increase of wages had been given to some of the head men. There can be no doubt that the Garden has benefited by the alteration, and that it is at the present moment in a state of greater efficiency than it ever was before: and at the same time the expectation expressed by the last Committee that the new arrangements would not be attended with increased expense has been entirely justified, for it will be seen by the following table that the labour account in the last three years has been respectively 1546*l.*, 1568*l.*, and 1554*l.*

Return of Amount paid for Labour at the Garden for the three last Years.	1849-50			1850-51			1851-52		
	£.	s.	d.	£.	s.	d.	£.	s.	d.
Weekly Ordinary Labour	1010	15	0	1077	19	6	1332	1	9
Labour charged to "Exhibition Expenses" .	402	1	0	314	18	2	191	8	4
Extra	..			52	9	0			
,, ,, "Garden Repairs" . .	61	12	9	54	0	0	31	8	9
,, ,, "Distribution Expenses"	72	11	0	68	16	0	..		
	1546	19	9	1568	2	8	1554	18	10
,, ,, "New Works" . . .	84	7	3	286	8	4	135	7	6
,, ,, "American Exhibition"	..			..			66	7	6
Total	1631	7	0	1854	11	0	1756	13	10

Thus it will be seen that the apparent increase in the cost of labour just referred to arises out of the manner in which it has been charged in the Society's accounts, and does not show any real excess of outlay.

Exclusive of the affairs of the Garden the points on which the Council have to report relate to finances and general administration.

During the year just elapsed one very important change has been made in the resources of the Society. In the beginning of the year 1851 it was represented by one of the Fellows that it would be only an equitable arrangement if those who had long been annual subscribers were allowed to compound for all further payments at a lower rate than that of ten years' purchase. A Fellow, for example, who had paid 4 guineas annually during 20 years, seemed entitled to compound at a different rate from one newly elected, and from whom no annual payments whatever had been received. After a very careful consideration of this suggestion the Council were of opinion that it would be beneficial alike to individual Fellows and to the funds of the Society if an alteration in the amount of life subscriptions or compositions were made upon the following plan:—

To pay when first elected, 42*l.*; at the end of seven years, 31*l.* 10*s.*; at the end of fourteen years, 26*l.* 5*s.*; at the end of twenty years, 21*l.*

It was therefore resolved to recommend to the Fellows, that the existing By-law relating to Compositions should be repealed, and a new By-law passed, giving power to the Council to accept the modified amounts just mentioned. After passing through the forms required by the Charter, this proposition was affirmed at a General Meeting, on the 17th of February of the present year, and

is now one of the laws of the Society. In coming to this conclusion, the Council have also resolved that the sums thus received should be applied exclusively to the extinction of debt so long as any liabilities remain, and should afterwards be funded, the interest only to be employed as annual income. Up to the 12th of April the following Fellows had taken advantage of this By-law:—

	£.	s.	d.
Colonel Challoner, after paying 16 years' subscription, by further payment of	26	5	0
Rob. Hildyard, Esq., after paying 16 years' subscription, by further payment of	26	5	0
Sir C. Lemon, Bart., after paying 26 years' subscription, by further payment of	21	0	0
W. H. Fox Talbot, Esq., after paying 28 years' subscription, by further payment of	21	0	0

On several occasions it has been urged upon the Council, that the Quarterly Journal might be sent by post to distant Fellows at the charge of the Society, but no decision had been arrived at till the present year, the Council being unwilling to add 50*l*. a year to the expenses of the Society for such a purpose. The question having however been again taken into consideration, the Council have arrived at the conclusion that the measure may be conducive to the interests of the Society, as well as agreeable to the Fellows, and they have therefore sanctioned the expense.

The question of renewing the lease of the Garden, according to the provisions of the covenant therein contained, by paying a fine of 450*l*., has been very carefully discussed, and the Council have decided that the rapid advance of the metropolis westward, together with the long unexpired term of years for which the Garden is still held, renders it inexpedient to take any steps in the matter. The present Garden lease will therefore expire at Michaelmas, 1881.

The following Balance-sheet has been prepared by the accountant, and passed by the auditors on behalf of the Society.

AUDITED ACCOUNT OF THE HORTICULTURAL SOCIETY OF LONDON.

Receipts, Payments, and Liabilities from the 1st of April, 1851, to the 31st of March, 1852.

RECEIPTS.

		£. s. d.
To compositions for life from Fellows		241 10 0
To annual subscriptions		2533 12 0
To admission fees from Fellows		107 2 0
To Quarterly Journal sold		26 4 3
To Transactions and Fruit Catalogues sold		6 9 6
To rent of apartments let off in Regent Street		150 0 0
To garden produce sold		28 3 1
To receipts from Fellows for garden charges		36 5 6
To miscellaneous receipts		30 13 6
To Garden Exhibitions, 1851		5046 7 6
To American Exhibition, 1851		18 7 0
		8224 14 4
To Sir W. P. Call and Co. on loan, 2nd Feb., 1852		500 0 0
To Balance at Banker's, 1 April, 1851	£117 13 0	
ditto with Vice-Secretary, ditto	9 3 7	
		126 16 7
	£	8851 10 11

12 *April*, 1852.

We have examined this account with the Vouchers, and find the same to be correct.

SAMUEL F. GRAY, } Auditors.
CONRAD LODDIGES, }

PAYMENTS AND LIABILITIES.

		Payments. £. s. d.	Liabilities. £. s. d
By interest on loan notes, &c.		268 18 11	
By rents, taxes, rates, &c., Regent Street and Chiswick		228 16 3	414 14 10
By repairs, furniture, &c., Regent Street		32 5 1	53 19 5
By housekeeping expenses ditto		32 17 7	
By salaries and wages, collector's poundage, &c.		765 5 8	201 1 4
By cost of Quarterly Journal		228 0 9	84 0 3
By cost of Transactions and Fruit Catalogues		5 3 6	5 18 9
By library charges		22 8 5	
By printing, stationery, &c.		68 11 7	13 10 8
By foreign missions and imports		1 2 7	
By expenses of meetings, postage, carriage, &c.		76 12 11	
By garden labour		1332 1 9	
By implements, mats, seeds, &c.		89 8 0	29 0 6
By tan, dung, &c.		31 11 9	
By coals and coke for garden		18 13 9	78 0 0
By miscellaneous expenses at garden		127 16 4	
By garden repairs		80 2 8	29 2 7
By distribution expenses		61 10 1	63 5 0
By Exhibition expenses, 1851		1143 6 6	2 0 0
By American Exhibition Expenses, 1851		204 1 1	71 4 7
By new works at garden		342 7 6	17 15 2
By Law Expenses 1850 and 1851		20 18 6	
		5182 1 2	1063 13 1
By medals' account :—			
Balance outstanding, 1 April, 1851	£493 18 6		
Awards, &c. since	1120 0 0		
	£1613 18 6	1178 11 6	435 7 0
			1499 0 1
By Sir W. P. Call and Co., Loan, 30th Nov., 1850, repaid		1000 0 0	
By outstanding accounts, 1 April, 1851, paid off		1378 9 11	
By Balance at Banker's	£98 12 1		
ditto with Vice-Secretary	13 16 3		
		112 8 4	
		8851 10 11	

A. DUNCAN, Accountant,
10, Tokenhouse Yard.

	£. s. d.	£. s. d.
Amount of Debt 1st April, 1851	. .	8145 11 10
Amount of Debt 1st April, 1852, *viz.*,		
To Creditors on Loan Notes	5400 0 0	
To Sir W. P. Call and Co. on Loan	500 0 0	
To Liabilities, as above	1499 0 1	
	7399 0 1	
Less Cash Balance	112 8 4	
		7286 11 9
Reduction in Debt since 1st April, 1851		859 0 1

Upon analysing the items in the Balance-sheet, and comparing them with the corresponding items in the accounts of last year, it will be found that the receipts have been greater by the sum of 558*l.* 0*s.* 10*d.*, as shown by the following statement:—

Income.	1850–51			1851–52		
	£.	s.	d.	£.	s.	d.
Compositions for Life from Fellows . . .	84	0	0	. .		
Annual Subscriptions	2825	6	8	2533	12	0
Admission Fees from Fellows	88	4	0	107	2	0
Quarterly Journal sold	69	13	0	26	4	3
Transactions and Fruit Catalogue sold . .	15	14	3	6	9	6
Rent of Apartments let off in Regent-street .	150	0	0	150	0	0
Garden Produce sold	14	0	8	28	3	1
Receipts from Members for Garden charges .	35	1	6	36	5	6
Miscellaneous Receipts	40	19	5	30	13	6
Garden Exhibitions	4102	4	0	5046	7	6
American Exhibition, 1851	. .			18	7	0
Total	7425	3	6	7983	4	4

It will also be observed that in the present year the amount of 241*l.* 10*s.* received for compositions is not included, although 84*l.* form part of the receipts called income in the previous year. If this last sum is removed from the account, as it must be if a fair comparison is to be instituted, the increase of real income during the year will amount to 642*l.* 0*s.* 10*d.* In subscriptions there is a falling off of 291*l.* 14*s.* 8*d.*, in great measure on account of the small amount of old arrears left to be collected after the operations of previous years. Such arrears in fact amount, at the date of this Report, to no more than 672*l.* 5*s.* 4*d.*, of which it is supposed that about 130*l.* is irrecoverable. On the other hand, although the admission fees have been reduced from 6*l.* 6*s.* to 2*l.* 2*s.*, the total received for them is 18*l.* 18*s.* more than last year; a very important feature in the account. In fact while only 22 Fellows paid their admission fees in 1850-1, the number this year has increased to 51.

The particulars of expenditure in 1850-1 and 1851-2 are given in the following statement:—

Expenditure.	1850-51 £.	s.	d.	1851-52 £.	s.	d.
Interest on loan notes, &c.	287	8	2	268	18	11
Rents, taxes, &c., Regent-street and Chiswick	655	16	10	643	11	1
Repairs, furniture, &c., Regent-street . .	23	11	8	86	4	6
Housekeeping expenses ditto	35	11	5	32	17	7
Salaries and wages, collector's poundage, &c.	1013	14	10	966	7	0
Cost of Quarterly Journal	303	7	2	312	1	0
Cost of Transactions and Fruit Catalogues .	10	3	8	11	2	3
Library charges	11	5	0	22	8	5
Printing, stationery, &c.	55	18	6	82	2	3
Foreign missions and imports	30	11	5	1	2	7
Expenses of meetings, postage, carriage, &c.	66	4	11	76	12	11
Garden labour	1077	19	6	1332	1	9
Implements, mats, seeds, &c.	116	8	10	118	8	6
Tan, dung, &c.	50	1	11	31	11	9
Coals and coke for Garden	129	0	7	96	13	9
Miscellaneous expenses at Garden . . .	140	3	5	127	16	4
Garden repairs	92	12	5	109	5	3
Distribution expenses	170	15	1	124	15	1
Exhibition expenses	1107	2	1	1145	6	6
New works at Garden	1044	3	2	360	2	8
Law expenses, 1850 and 1851	. .			20	18	6
American Exhibition expenses, 1851 . . .	. .			275	5	8
Cost of medals awarded	1128	4	6	1120	0	0
Total . . .	7550	5	1	7365	14	3

Here the Council find a reduction of charge to the extent of 184*l.* 10*s.* 10*d.*, although in the previous year there was no expense incurred on account of the American Exhibition, or for law-charges, and little for repairs of the house in Regent-street, which have this year been increased to the extent of 62*l.* 12*s.* 10*d.* by repainting the Meeting Room, and the purchase of gas stoves for heating it; from the latter some future saving in fuel is expected, as well as a degree of cleanliness that has long been rendered impossible, on account of the incurable smokiness of the chimneys. The apparent augmentation of the charge for Garden Labour has been already explained; and the other items in which an inconsiderable increase is observable are in their nature of a fluctuating character. Upon the whole it will be found that the result of the year's operations is, that the Society's Debt is reduced by the sum of 859*l.* 0*s.* 1*d.*, as under :—

Income as detailed . .	£7,983	4	4			
Expenditure ditto . .	7,365	14	3			
				617	10	1
Compositions for Life from Fellows applied specially to the reduction of the Debt, and no longer considered as Income . .				241	10	0
				£859	0	1

which agrees with the account of Reduction of Debt at the foot of the Balance-sheet.

ORIGINAL COMMUNICATIONS.

XII.—*Observations on the Diseases of Plants as illustrated by the Potato Murrain.* By Dr. Schleiden.

[The present memoir, which is here very slightly abridged, to avoid needless repetition and render it more suitable to this Journal, appeared in the form of an appendix to the treatise of which an account has been given in the two previous numbers. Though the primary subject is in itself scarcely calculated to excite attention after so much has been written on it and is still daily overloading the Continental press, it is of great importance as regards its general bearing on the diseases of plants, and for this reason is submitted to the Society.]

The general features as well as the especial marks of distinction which are exhibited by the more important diseases to which potatoes are subject, are so extremely various, that it is necessary to examine a large quantity of specimens before we can draw up the essential characters of any particular disease, so as to be entirely free from individual and local circumstances. Since the first appearance of the potato-murrain I have paid constant attention to the subject, collected all possible information, and carefully examined a great quantity of tubers from all parts of Germany, without however finding any reason to alter the views which I entertained in the year 1845. My prediction that the malady was independent of temporary causes, and that it would never disappear, has, at least at present, been sadly verified.

1. The following general remarks, which are founded on information derived from various quarters, are of great importance to the due estimation of the nature of the disease.

And first I must protest against the erroneous notion that the malady is of recent origin. The cultivation of potatoes diffused itself very slowly over Europe, and especially in Germany. From its very first commencement complaints were made of degeneration and disease, which became still louder and more urgent as it extended; and indeed every one well acquainted with the history of the potato is aware that from the middle of the last century, a few years only were free from disease, every succeeding year in general exhibiting some more aggravated and widely extending form.

General attention was first attracted to the subject in particular countries in 1840, which extended in 1845 to the whole of Europe. Since the former date disease has been more or less prevalent, though the climatic conditions have been as various as possible. No especial variety has been entirely exempt, or indeed has universally exhibited the disease in a milder form. No single kind of soil has been entirely free, or even peculiarly privileged. In the neighbourhood of Jena, for instance, cases have occurred where potatoes have succeeded extremely well in ill-drained moors, while the crops in the neighbouring sands have been worthless. No particular situation seemed to make any difference, with the single exception, and that of some importance, of the whole extent of coast on the North Sea, as far as the immediate influence of the sea-fog extended. Whether the crop was raised from seed, from entire tubers, from sets or eyes, the result was just the same; or perhaps those crops which were immediately derived from seed exhibited the worst form of the disease. Moreover, the crops suffered indifferently, whatever peculiar place in the usual rotation they might occupy, except indeed that the murrain appeared the latest, and was first ameliorated, where potatoes, as in Thuringia, are never planted, on a large scale at least, in fresh manure. The first symptoms of disease appeared in the tubers as soon as in the haulm, or even sooner. It is at least indubitable that highly diseased tubers proceeded from perfectly sound haulm, in which therefore the cause of the disease could not reside, nor could it be propagated from the green parts to the tubers. On the same plant sound and highly diseased potatoes frequently occur, and in the same heap during winter sound tubers are found amongst those which are quite putrid, from whence I conclude that the disease is not communicated by contagion.

2. The first symptom of the disease consists of brownish discoloured specks which extend from the superficial cells inwards. The nitrogenous lining of the cells, which in sound tubers is colourless and uniform, assumes the appearance of a pale yellow membrane. As the disease increases, this membrane is finely granulated, giving off reticulated threads in which a distinct circulation is often visible. The nucleus at the same time becomes sharply defined; the nitrogenous coat assumes a darker tint, the starch-grains are absorbed exactly as in a sprouting potato; in short the phenomena are the same as occur generally in germination, a circumstance which agrees remarkably with the fact that diseased potatoes, when they do not pass too rapidly into a state of putrescence, have a surprising tendency to germinate, in consequence of which, after three or four weeks, they are often covered with young tubers.

In process of time the intercellular passages, which normally are filled with air, are injected with a yellow fluid. This takes place even in the vessels, when once they are attacked by the disease. In this fluid sharply defined granules soon appear, and at length mycelium arises both in the intercellular passages and cells. The individual cells separate from each other, their walls become attenuated, and at length disappear. In general the starch-grains remain involved in fungal threads, and the whole dries up into a hard white mass, or if the decay is more rapid, the amylum is destroyed, so that frequently nothing remains of the whole potato except a thin sac filled with a fetid fluid. Parasites, whether insects or fungi, are never original, but developed on the diseased tissues.

3. I shall now offer some remarks on the chemical condition of the infected tubers.

The juice of sound potatoes is slightly acid, whereas the diseased spots exhibit at times a weak alkaline reaction. As the disease increases, sometimes a decidedly acid, sometimes an equally distinct alkaline reaction takes place, without any assignable reason ; in the latter case the circumstance does not depend alone on the presence of ammonia. The highly fetid tubers react clearly on ammonia, as is of course the case in the decomposition of nitrogenous substances. The walls of the diseased cells are at first blue when treated with iodine and sulphuric acid, then, as the disease is progressing, successively greenish blue, green, and greenish yellow, and finally dark golden yellow or brownish yellow. The nitrogenous matters become darker when treated with iodine in proportion as the disease advances, and, according to Liebig, consist no longer, or at least not principally, of albumen, but of casein.

The starch grains, in all potatoes which are strongly affected, even in the cells which still remain sound, exhibit a peculiarity which distinguishes them from the starch of sound tubers. As soon as it is dry, a quantity of broad cracks are formed within them. This is never the case with sound potatoes, and proves that these bodies in diseased tubers are far more saturated with water than in those which are sound.

When boiled there is also a great difference. Diseased tubers boiled for four hours remain as hard as at first ; if they are then quartered, and the cortical layer removed, they remain unchanged though repeatedly boiled, while sound potatoes from the same field, after three hours, burst and separate into individual cells. The starch in the cells of diseased potatoes when boiled swells out into little gelatinous sacs, but these remain single and unconnected in the cells, and do not long fill them out.

Observations on diseased potatoes as compared with sound, by Payen, Schacht and Janssen, Petzholdt, &c., give the following

actual variations. The amount in water and ashes in diseased potatoes is absolutely more marked, in starch less so than in those which are sound. The albumen is relatively more marked in proportion as well to the starch only, as also to the collective non-nitrogenous constituents.

Most chemical analyses of diseased potatoes are useless inasmuch as they are made without any knowledge what is to be gained by analysis, and what questions are to be answered by it. One of the best and most worthy of confidence is that of Janssen and Schacht, but, like all similar analyses of plants, is deficient as regards the nitrogenous constituents. According to this the proportion of albumen to starch in sound potatoes is as 1 : 31,8 ; in diseased as 1 : 28,7 ; to starch, cellulose, gum and sugar collectively—in the sound as 1 : 25,8, in diseased as 1 : 36,6.

It is remarkable that diseased potatoes, according to this analysis, which in this respect is very careful, contain more cellulose than those which are sound, and if the cellulose is set down at unity, the following proportions are obtained, which perhaps approximately correspond with the proportions in the single cells.

	Sound Tubers.	Diseased Tubers.
Cellulose	1·00	1·00
Starch	10·66	5·15
Gum	0·24	0·18
Sugar	0·10	0·16
Albumen	0·93	0·18
Fat	0·02	0·05
Water	37·25	22·85
Ashes	?	0·25

In sound potatoes the starch is to the water as 1 : 3,5 ; in diseased as 1 : 4,4.

The best analysis of the ashes is that of Petzholdt.

In 1000 parts of fresh

	Waxy Potatoes.		Table Potatoes.	
	Sound.	Diseased.	Sound.	Diseased.
Water	761·	778·	753·	760·

In 1000 parts when dried at 100° C.

Ashes	37·64	40·88	45·15	48·19
When fresh	8·996	9·075	11·152	11·565

The proportions of the particular constituents of the ashes are more important here than the absolute quantities. These give, when the alkalies are set down at unity,—

	Waxy Potatoes.		Table Potatoes.	
	Sound.	Diseased.	Sound.	Diseased.
Alkalies	1.0000	1·0000	1·0000	1·0000
Lime	0·0079	0·0152	0·0116	0·0350
Magnesia	0·0593	0·0788	0·0722	0·1797
Chlorine	0·0594	0·0578	0·0531	0·0692
Sulphuric Acid	0·1010	0·0883	0·1073	0·0838
Phosphoric Acid	0·1977	0·2083	0·1979	0·2339

A marked excess of phosphorated lime and magnesia is exhibited here above sulphated and muriated alkalies.

4. This is not the place to treat on every individual malady to which plants are subject, but merely to bring forward the general points of view which arise from a physiologico-chemical examination of the little which we know of the diseases of plants. It is not my intention to advert to the destruction of plants or portions of plants arising palpably from external agents, but merely to examine the alterations which depend upon an inward abnormal condition.

Two things must here be distinguished, the diseases of plants in free nature and those under cultivation, including those wild species on which it exercises an indubitable influence, as corn-weeds. As regards the first, the question may be asked, whether diseases at all affect them, or are capable of doing so, when they are left entirely to nature, and are removed from every influence of man? The answer to this question would lead us too far. It is, however, indubitable that diseases do arise in apparently wild plants, as for instance the Tyrolese fir-woods were very generally visited by Rust in 1845. The causes of such diseases, however, may perhaps be completely external and merely transitory, and rest most probably on the peculiar atmospheric conditions of particular years, and therefore vanish of themselves in the succeeding season.

But in cultivated plants it is entirely different. Almost all of them are no longer in their natural condition, but, regarded in a scientific point of view, are in themselves deviations from their normal condition. The natural equilibrium in their formation is abolished by the unnatural and excessive development of especial circumstances of form or of particular elements, and they present, to the external injurious influences which in part subsist in the very modes of cultivation, a greater number of weak points. To this is added that a great part of the objects of culture are not in their natural climate, but in a zone which is strange and ungenial, and that consequently they are affected by a number of inevitable causes of disease.* It scarcely requires

* This mode of viewing the case leads to the comfortless conclusion, that we shall perhaps never be in a condition to extirpate completely the diseases of our cultivated plants, and that as with us people reckon on the tenth grain, but not upon the hundredth, as is the case in Chili, or as in some places in every great calculation a certain per centage is deducted for the probable destruction of hailstones, so it would be better, instead of writing thick volumes and even little libraries containing treatises on the occurrence and treatment of diseases, to collect correct statical data, with a view to calculate the mean loss due to disease, so as to make it harmless by reason of foresight. In a political point of view beyond doubt the firm establishment of such statical conditions is of the greatest importance, for in

an express intimation that the condition of a plant as an object of cultivation and its disposition to disease are perfectly identical. Both are alterations of chemical action in the plant, produced through the conditions under which it grows. All our cultivated plants, with very few exceptions, may be regarded as diseased; that is, as deviations from the normal process of formation of the species, and it is only the egotism of man which thinks otherwise of them, inasmuch as he finds his profit in these diseases as in the artificial enlargement of the liver in the Strasburg goose. The greater part, indeed, if not all the peculiar internal diseases to which plants as well as men are subject, arise from an improper, deficient, or more frequently too abundant, nourishment. In order, however, not to deviate too widely from the common mode of speech, I shall distinguish that condition of cultivated plants in which they deviate from the normal form which they exhibit when wild, in consequence of too abundant nourishment as a general inward tendency to disease.

This tendency, however, becomes specific when they belong naturally to a very light or sandy soil, as oats or potatoes, and are now cultivated on heavy ground, or if, in consequence of the plan of cultivation which was once universal, they are grown in the first year in which the land is manured, as wheat, rye, potatoes; or finally, if the climate in which they are cultivated deviates greatly from their natural place of growth, as is the case in wheat, maize, and potatoes. Under these circumstances very slight prejudicial influences are requisite, as for instance wet, cold, or extreme heat at an improper time, to cause the appearance of disease.

The only point which man has in his power is the avoidance of unsuitable soil and site in the cultivation of a plant, which will, however, be exercised by every intelligent agriculturist. Climate is beyond our power, and we cannot increase the general disposition to disease without at the same time hazarding the total loss of any particular species. The outer appearances of the diseases of vegetables are well known, and their specification belongs to the pathology of plants. The inward phenomena, as far as they have at present been examined, possess something general, which deserves a place here, since it points decidedly to the fact that the general tendency to disease is due to the influence of artificial culture.

As the physiology of plants turns on the investigation of the life of a single cell, if it is to be worked out with any degree of

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every country the most fearful difficulties arise, when a harvest fails on which dependence was placed. The loss is however entirely free from evil consequences where it has been calculated and provided for beforehand.

success, so also in pathological researches we must direct our attention exclusively to the alterations which the individual cells exhibit. In every living cell the substances proper to it are arranged on one simple plan. The wall of the cell is formed of firm, perfectly insoluble cellulose, which, after it has been penetrated with this or that matter, and has in consequence lost its purity, is in a condition to exhibit different appearances on the application of re-agents, but abstractedly always the same, and that a non-nitrogenous substance remains, in which, together with carbon, hydrogen and oxygen are present in the proportions in which they constitute water. This cell-wall is lined within by a coat of greater or less thickness, either yellowish or free from colour, consisting of a semi-fluid, somewhat coagulated, gelatinoso-granular substance, which is formed of a proteinous matter rich in nitrogen, and called by H. v. Mohl* the primordial sac. Finally, the inner cavity of the cell contains a highly mixed fluid, the medium of whose fluidity is water, in which a few nitrogenous, proteinous compounds are present, together with many which are non-nitrogenous, as gum, sugar, pectin, &c., soluble salts, and in a fixed form starch, inulin, and crystals.

The relation of the greatest consequence as regards the life of the cells seems to be that of the nitrogenous lining to the other substances, especially the non-nitrogenous, and the vigorous health of the cells to depend entirely on the normal condition of this stratum. When the cell is old and begins to perish (as for instance in the wood-cells), this coat gradually disappears, or is so closely united with the cell-wall that it becomes inseparable, while at the same time it penetrates it in a soluble state, and thus by degrees the original reaction on the cellulose is perfectly masked by the constantly increasing re-action on the proteinous combinations.

If we now examine the first deviations from normal phenomena which are exhibited in the occurrence of internal diseases, as for instance in smut (*Uredo segetum*), in decay, as in the stems of Cacti, juicy fruits, &c., or in the potato murrain, we find in every case that the nitrogenous lining of the cells first becomes discoloured, assumes a darker tint, a firmer consistence, a more evident granulation, and that it begins at the same time to percolate and saturate the cell-wall, so that it ceases to exhibit its pure reaction on the cellulose. These phenomena are so general

* It is matter of regret that the best organic chemists are so little agreed as to the normal constitution of cells. Schleiden's view is so much more simple than that which regards the proteinous lining as the original cell, that it bears the stamp of truth about it. Mulder's admirable work is, in our opinion, impaired very materially by his trusting so much to the fancies of Hartig.—Tr.

that we may well suppose that all inward diseases of plants actually derive their origin from an abnormal condition of this coat, and inasmuch as the peculiar power of the chemical process in the cells is apparently concentrated there, its depravation first calls into existence the symptoms of disease which are perceptible at a later period in the other portions of the cells.

I subscribe, indeed, to the doctrine first put forth by Saussure and Davy, and at a later period extended by Boussingault and Liebig, which lays so great stress on the inorganic substances in plants. I believe, as Liebig first expressed it, that the whole multiplicity in the vegetable kingdom, as far as it rests and depends on a chemical process, arises in the first instance exclusively from the action of the different qualitative and quantitative combinations of the inorganic substances which the plant receives from the earth, and that consequently its meagre or luxuriant growth, its healthy or diseased condition, must be derived from these substances. It appears to me, for instance, to be clearly established by the investigations of Boussingault and Liebig, that the formation of the organic substances of the Dextrin and Protein Category is entirely dependent on the presence of certain inorganic matters, without which the greatest superfluity of organic elements in the available combinations is utterly useless to the plant. Although it is indubitable that the formation of Proteinous matters depends on the presence of phosphorated salts, that of matters of the Dextrin group, on the contrary, of non-phosphorated alkaline salts, the following investigation will render the subject even more probable.

The proportional rarity of phosphates in most geological formations, and also in the soils which are wholly or principally formed from them, is well known; on the contrary, they are accumulated in soils principally formed of decomposed vegetable matter after being slowly collected by the plants. Animal excrements are very rich in these salts, and therefore manured fields, and especially gardens, contain a greater proportion than is normally present in plants, or can be consumed by them. But the influence which inorganic substances in the soil exercise on vegetation depends upon their being generally present. For since plants have not the power of choosing their own nutriment, and since the proportions in which soluble substances present themselves for absorption can be altered by endosmose within very narrow limits, it is equally important that the substances which are requisite for plants should be contained in the soil in something like the proper proportions, since the plants are otherwise compelled to receive matters in greater quantities than is agreeable to their normal structure, and in consequence inevitable anomalies take place in their vital action.

The sum of what has been said may be stated thus:—The more phosphates are relatively increased in any soil in consequence of its mode of formation or cultivation, the more will the plants which it sustains have a tendency to deviate from their original type, to form sub-species and varieties, and finally to be attacked and destroyed by internal diseases.

5. But to apply the general principles which have been adduced to a particular case.

The potato is a fleshy tuber, which, together with a great proportion of water, contains a marked quantity of starch, with an extraordinarily small amount of proteinous matters. All combinations of protein, it is well known, are greatly subject to decomposition when in solution; and, indeed, as soon as this takes place, affect in a similar manner even such substances as starch and cellulose, which slowly, and with difficulty, yield to the decomposing power of atmospheric influences.

What an effect, then, must the condition which our cultivated fields present have upon a plant subjected to such treatment? The answer to this question leads to very striking results.

I will, however, first remark, that every natural soil that is formed exclusively of shattered and decomposed rocks contains very little phosphorus; and though sufficiently so for most wild plants, is by no means over rich in alkalies. The first arising from the general rarity of phosphates, the second from the soluble alkalies being washed out by the rain and carried to the springs and rivers, and thence to the sea. A quantity of phosphates are, however, brought to the soil with manure, which, in proportion to the alkalies, is far greater than is needed by any plant in a normal condition.

In examining the inorganic matters of plants and soil, attention has hitherto been directed almost exclusively to the circumstance, whether the inorganic constituents of the latter are actually in sufficient abundance. This method is far from satisfactory, and does not embrace every necessary consideration. For a plant is not endowed with sense to choose what is the most proper amongst the several nutritious matters which surround it. The reception of nutriment, as appears by the most careful experiments, depends exclusively on the attractive power by which two different matters strive to combine with each other—a power which Dutrochet, in the particular case which has the greatest resemblance with the circumstances of the absorption of nutriment by plants and animals, has distinguished by the name of endosmose, which is wrong and inapposite in the case before us. According to the laws of this species of attraction any substance dissolved in water is always attracted by another fluid, if such fluids in general (as water and albumen, gum and sugar) are

opposed to one another. This does not, however, always take place in such a manner that the matter in solution is taken up in the same proportion in which it is present in the solvent water; nevertheless, in the case of the fluids which most frequently occur, and the constituents usually dissolved in the water present in the ground, the limit is so wide that the quantities extend far beyond the necessities of a plant.

According to these premises, the point is not merely that the matters, which the plant must find as nutriment in the ground, must be generally present, but more especially that they must exist in the ground in the same, or nearly the same, proportions as they do in the plant when healthy. Every abnormal proportion will compel the plant to take a nutriment unsuitable to its nature, the consequence of which will be that the chemical process by which the organic matters are formed will be modified, and a relation of these matters induced which recedes from that of a plant in its normal condition; and cases may arise in which matters which ought to be present in the plant may entirely fail, while other analogues may take their place and altogether new compounds be formed. Thus in the cases adduced by Liebig, where the requisite inorganic bases or acids fail, the plant forms organic bases or acids which supply the place of those which are wanting.

In every plant a certain normal proportion is found between the combinations of protein and those of dextrin. A deviation from these by no means necessarily infers the destruction of the plant, for in our agricultural plants the very point we aim at is the regular predominance of some particular constituent. We see, for instance, how extremely different the proportions may be in the seeds of our cultivated wheat without the existence of the plant being endangered. But it is equally notorious how many diseases it is exposed to, as bunt, rust, mildew, &c.; and every intelligent cultivator agrees that seed-corn should be selected from the most barren land, since that produces the healthiest and most vigorous plant, and gives the surest and richest return.

Liebig has strived very cleverly to prove the intimate connexion which makes the formation of dextrinous matters dependent on the presence of alkaline salts: he and Boussingault have shown in their analyses in what a close reciprocity the protein matters seem to stand to the phosphates. If these doctrines are not free from objection, yet thus much is certain—that the presence and the proportion of phosphoric acid to the alkalies stands in the closest relation to the formation and the proportions of the combinations both of protein and dextrin.

Now by means of manure which consists of animal excrements, phosphates are continually carried to the soil in greater quan-

tities than alkalies, and thus the former are increased not merely absolutely, but also relatively. And in our agricultural plants the protein combinations are strikingly increased and indeed modified, by which means they show most plainly the influence which has been exercised by the manured soil.

No evil consequences will appear in those parts of the plant in which matters are collected in a dry condition, as in the seeds of our cereals or pulse, or which, as they are formed, are gathered and consumed. Where, on the contrary, the processes to which parts of plants are subjected after their collection, require for their success a peculiar kind of admixture, a deviation from this will show itself in unfavourable results, as in the use of beet for the manufacture of sugar grown on ground newly and richly manured, or of barley for malting from fields which are extremely fertile. Finally, where the parts in question contain constantly a large quantity of uncombined water, where the proteinous matter consists of dissolved albumen or casein, and the normal albumen is perhaps changed through the influence of cultivation into casein, which is still more liable to decomposition, all requisites are present for the most manifold putrefaction and decomposition, and the most fatal consequences will often arise from slight outward influences, so that it will depend on casual accidents in what particular shape the process of destruction may appear.

This last-mentioned case is exactly what takes place in potatoes. The albumen may slightly exceed its normal quantity in the tubers, which are always rich in uncombined water, or may be changed into casein, in consequence of which they are highly subject to decomposition. It may then depend on different outward influences whether disease attack the starch especially, as in the wet rot, or the cell walls, as in the dry rot. Now if we compare the phenomena of the potato murrain with the chemical investigations which have been made, there can be no doubt that the disease actually consists in an abnormal proportion of proteinous matter in the potatoes, and that this deviation probably answers to a greater quantity of phosphates in the diseased tubers. All potato diseases, of which we have anything like perfect details, are characterised as deviations from the normal process of vegetation which have arisen from cultivation. The dry rot, which was so prevalent in 1842-43, and the disease which since 1845 has made such dreadful and such constant havoc in our fields, the only diseases which have been carefully and scientifically examined, are both characterised by a putrefactive process, induced by the abnormal condition of the proteinous matter, affecting in the first the starch, in the second the cell walls.

In a word, observation shows these diseases to be such as must

necessarily, or at least most probably, arise under cultivation. Their essence lies in a degeneration consisting in an abnormal condition of the proteinous matters; their cause in the mode of cultivation; the accidents inducing or accelerating the eruption of the maladies, external, local, or temporary influences, as very moist soil, peculiar weather, &c.

This view of the essence of the disease consisting in a degeneration of the species is by no means new, though different from the notions of all who have treated of the subject in its fulness and the arguments on which it rests. The grounds which others have built upon are generally merely local or confined. They have adduced as causes of degeneration the circumstance of never renewing the crop from seed, the use of divided potatoes or eyes as sets, the mode of keeping the sets during winter, and other circumstances. Such views are, however, contradicted by the fact that the circumstances were very different in the different countries where the disease prevailed. In many places the plants raised from seed were peculiarly subject to attack, and besides published cases I can refer to one which occurred to a clergyman at Jena who for a long time has paid particular attention to this mode of raising potatoes. The disease has been not less virulent where it has not been the custom to grow potatoes from sets. We must look then for some other cause. Such notions, indeed, are of no avail except when to conceal ignorance they are masked by such general expressions as debilitation of potatoes, corruption of the juices, &c. The fact is incontestable, that the disease is first manifested in the proteinous matters of the cells, that they are relatively increased and altered in quality, while the starch, on the contrary, is relatively diminished, and also, though less decidedly, altered in quality; that the relation of the phosphates and alkalies is surprisingly changed. All these circumstances, however, according to late scientific improvements, are closely connected with each other, and no views respecting the cause of disease can lay claim to any respect, which do not at the same time at least show the possibility of this especial result arising for the reasons assigned from chemical laws.

On the contrary, this view is altogether calculated to verify the required connexion, and to infer the result from the premises not only as possible, but as probable, in a very high, if not necessary degree. This view perfectly explains all the conflicting phenomena which have appeared during the expansion of the disease, since it constantly places the outward circumstances which must naturally act differently on almost every individual plant, in apposition with the inner specific tendency to disease. It explains, moreover, perfectly the surprising circumstance that in the same field—nay, even on one and the

same plant, sound and highly-diseased tubers occur close to each other; for it scarcely requires explanation that the soil of the same inclosure is by no means a uniform admixture of the substances which it contains. The luxuriant vegetation and deep green in certain spots points out in the second year the places where the manure heaps were laid, and from whence they were distributed over the surface. Every decided difference of soil, however local, must necessarily induce a difference of vegetation, and especially of the chemical process in the plant, so that individual tubers may be exposed to injurious action in very different degrees.

6. One of the most practically important questions which now arise is, whether the disease which has prevailed since 1845 is to be regarded as an isolated fact, as a circumstance induced by a rare and altogether peculiar concurrence of circumstances, or whether in future similar dangers threaten us. The answer to this question will naturally be very different, according to the views which are entertained of the malady. Those which have at present been put forth may be arranged under three heads:—1. It is attributable either to vegetable or animal parasites. This merits no further notice, for it can escape only the most superficial observation that the diseased symptoms occur, without exception, before the least trace of the parasites is visible, and the most numerous voices, and those of most weight in science, have been raised against it. 2. Others attributed the disease to the peculiar weather of 1845, and prophesied its total disappearance in more favourable years. Painful experience has disproved any such opinion, but unfortunately observation has in consequence been diverted into a wrong channel. 3. The right view, and that which has most promise for the future, springs from the history of the potato. It thence appears that the malady is no isolated fact, but that diseased action has from the earliest records increased in extent and intensity.

Potatoes, with rare exception, have been grown in freshly manured soil. In all schemes of rotation our best authorities commence with the potato, and some direct the set to be placed immediately on the manure. Putsche and Vertuch, in their monograph, declare that the ground cannot be over-manured. These views have continually been more firmly held, in proportion as the cultivation of the potato has extended. In a few parts only of Germany, especially in Thuringia, as abovementioned, a custom has been pretty well established not to plant potatoes in fresh manure, but as the third or fourth crop, and generally after clover, and these parts are precisely those which remained the longest free from disease, and which suffered the least.

On a perfect comparison of the contents in ashes of different kinds of manure with those in a sound tuber, it appears that if the alkalies are put down at unity, the magnesia and phosphoric acid in the dung are too great. We must. however, remember that sound potatoes are not at present in their normal condition in consequence of the established mode of culture.

The following table, compiled from the details given by Dr. Schleiden, will exhibit the matter clearly and usefully, the alkalies being in every case placed at unity.

	Alkalies.	Lime.	Magnesia.	Chlorine.	Sulph. Acid.	Phosph. Acid.
Potatoes, haulm, and tubers	1·000	0·075	0·070	0·059	0·102	0·214
Human ordure . .	1·000	1·348	0·142	0·366	0·221	0·631
Human urine . . .	1·000	0·072		0·225	0·446	0·344
Cow-dung mixed with urine	1·000	0·229	0·079	0·396	0·178	0·384
Horse-dung mixed with urine	1·000	1·458	1·122	0·212	..	2·175
Soluble portion of guano	1·000	1·994	0·242	0·720	0·727	2·520
Beech ashes . . .	1·000	1·553	0·471	..	0·085	0·322
Fir ashes	1·000	2·510	0·553	..	..	0·378
Human bones . . .	1·000	47·431	0·800	0·884	..	45·831
Bones of oxen . .	1·000	21·917	0·580	0·901	..	24·963
Common stable dung .	1·000	1·102	0·461	0·076	0·243	0·384

If then what has been said about the malady and its causes be correct, the practice of planting potatoes in newly manured soil, and of employing the kinds of manure just enumerated, the disposition to disease must increase more and more, and slight circumstances will be sufficient to cause its eruption. If very favourable years allow us to hope for a sound harvest, such expectation will be more and more deceptive every year, and a time will at last come when potatoes, instead of affording the surest crop, will be the most precarious.

Comfortless as this view is, when we reflect how large an influence a favourable potato harvest has, not only on the welfare of most people in Europe, but even on the possibility of their existence, yet, on the other side, the way is thus laid open which must be taken to avert with certainty the threatening evil.

This consists in a general alteration of our mode of culture and in the whole system of rotation. Potatoes must henceforth, if we hope to avoid the apprehended consequences, be universally excluded from the commencement of any system of rotation. The particular place in the course I will not attempt to decide, since so many purely practical circumstances must be regarded which cannot be measured by theoretic principles, and distinguished

beforehand. I shall merely hazard the following indication without attributing too much value to it, since the rotation depends not entirely on the chemical circumstances attendant on nutrition, but perhaps quite as much on the state of aggregation in which the soil is left by particular crops, as also on the quantity of humus it may contain. The proportions are again arranged in a tabular form for the sake of easy comparison :—

	Alkalies.	Lime.	Magnesia.	Chlorine.	Sulph. Acid.	Phosph. Acid.
Ashes in wheat harvest, including straw	1·000	0·305	0·124	0·140	0·021	0·550
Subtracted from the proportions in stable dung given above, multiplied by 3 .	1·000	1·500	0·629	0·044	0·354	0·301
Ashes in rye harvest, including straw .	1·000	0·338	0·283	0·025	0·073	0·830
Subtracted, as before, from the proportions in stable dung, multiplied by 3. . .	1·000	1·484	0·550	0·101	0·328	0·161
Potato crop . . .	1·000	0·075	0·070	0·059	0·102	0·214

In the case of wheat, the residue of manure after harvest is in the same unfavourable condition for the cultivation of potatoes as wood ashes, as appears from the former Table, while in that of rye the result is decidedly favourable.

Most agriculturists agree that rye is most fitted for newly manured land, which is clearly attributable to its greater amount of phosphoric acid. The best rotation then seems to be to begin with winter rye, and to let potatoes follow. I do not, however, give this as a decided fact; all I would assert is, that the place usually given to potatoes is the worst and most destructive.

The choice, however, of another system, if it is to lead to the desired result, must not merely be tried by individuals; but the earlier methods of cultivation must be abolished, at least as generally as they have been hitherto firmly established. But unhappily in the very nature of things, any legislative measures can have no effect, even supposing the views I have developed to be true. The only measure which a government can take, is to provide by every means at its disposal for the instruction and enlightenment of cultivators, so that on the one side they may possess such well-grounded knowledge of natural science as may enable them to comprehend facts in their just connexion or as actual experience, instead of opposing raw empiricism or the mere observation of facts with the self-sufficiency of ignorance to scientific discussion, and on the other side landowners may

bring themselves to such a national economical illumination, that their own interest may go hand in hand with the well-being of the whole state, and the first cannot long continue without the last; whereas at present a narrow-mindedness is frequently exhibited, which with confined views works against its own interest, while it holds the nearest profit as the surest, forgetting that a speculation for ten days in the case of mortal men is not more sure than one for ten years.

XIII.—*On Style and Expression in certain Trees and Shrubs; their Adaptabilities, &c.* By Robert Errington, C.M.H.S., Gardener to Sir Philip de Malpas Grey Egerton, Bart., M.P., F.H.S., Oulton Park, Tarporley, Cheshire.

(Communicated April 16, 1852.)

Landscape gardening in its strict sense has scarcely kept pace with what has been termed the Gardenesque of late years; and why? Simply I suppose from the fact, that where there is one person who can appreciate the beauties of lines and forms independent of colour, there are a score who cannot; but who nevertheless are, it may be, adepts at what is termed "clumping" flowers and all the paraphernalia of the flower garden.

Whilst, however, England sustains her position in the van of civilisation, so long must true landscape gardening be fostered; and it must be confessed, that we owe its preservation and encouragement mainly to our aristocracy, who are ever in a better position to appreciate its value than any other class of society.

My purpose is to draw attention to the beauties of form in certain trees and shrubs, old-fashioned kinds or not, and to point to their eligibilities, whether in the park, the ordinary pleasure-grounds, or the flower-garden. As country seats differ—and indeed should do so—as to their general tone or expression, sometimes through position and adventitious circumstances, and sometimes as a matter of design, it follows that a judicious adaptation of trees and shrubs becomes necessary, whether as accompaniments or as constituting a portion of the chief features of the grounds. In most of the pleasure-grounds connected with the seats of our nobility and gentry, certain by-scenes, retreats, nooks, or decorative adjuncts occur, which either possess a kind of individuality, or require it to be created by the skill of the artist. Hence the necessity for a nice perception of the character and ultimate expression of trees and shrubs. The grave and the gay would be terms far too sweeping in their signification to embrace

all the objects required in extensive gardens. From the mausoleum to the parterre may exist several intermediate characters, each requiring a separate impress, yet merging into each other. For instance, there may be the rosary, the American ground, the decorated promenade, the terrace, rock-work, &c.; and as matters farther from home, walks and adjuncts connected with the margins of the park, the lake, the woodlands, the grove. It need scarcely be urged that each of these requires peculiarity of style in the trees and shrubs which are used as accompaniments. There exists, moreover, in addition, a demand for trees and shrubs adapted to the various styles of architecture; and to the vestibule, the corridor, balustrades, arcades, the conservatory, &c.

Thus far I have pointed to a few of the chief objects, in order to show the demand for a variety and choice of materials, and to mark the existence of such, and to claim in some degree for the landscape gardener an immunity from the ordinary bondage imposed by the great goddess Fashion: the genuine landscape gardener caring more for lines and forms than gaudy colours.

Mere novelty and colour, then, being set aside for a moment, I would beg to advert to what we may term style and expression in trees and shrubs, and with much deference submit the following, which is capable of amplification:—

Forms:—

Round or flat-headed, generally massive.
Pointed or spiry.
Columnar.
Fastigiate.
Horizontal.
Weeping.

To these common terms, as descriptive of general forms, may be added certain other characters or habits; such as the tinted, or those which impart a solemn grandeur or richness, at the season of fading, in our early autumn or winter months. Feathery and light branched trees or shrubs. adapted in a special way to the vista or glade, rock-shrubs and trees, those adapted to the banks of water; climbers, creepers, twiners, berry bearers, and variegations; with the coarser and more rustic-looking things, as leading to or connected with the woodlands, the fields, or the moor.

I will now point to a few trees and shrubs in each of the classes, begging it to be understood that they may be either old or new, their suitability alone being the assumed ground of merit.

Round or Flat-headed Section.—Foremost, "the gnarled and unwedgable Oak"—everybody's favourite. Here we have one of

the finest contributaries to a bold sky outline—in age exhibiting broad and heavy masses of foliage, disposed in well defined, abrupt, and even angular breaks; added to which a tortuous and rugged bark—a bold relief amongst trees and shrubs of tamer character. The Beech, too, a tree for the park, the grove, the glade, or the vista. The Sycamore, which, although when young, is of no significance, attains a character in age frequently of much consequence to the scenery where it is situate; the foliage in this case running into heavy masses, with deeply indented breaks in the outline. The Scotch Fir in age frequently attains a most picturesque appearance. In this section we have such trees as the Elm, the Lime, and various others.

Pointed or Spiry.—Such as the Lombardy Poplar, the Taxodium sempervirens, Douglas Pine, Larch, Silver Fir, and several other Conifers, with the beautiful Cryptomeria, and many ornamental shrubs. Trees and Shrubs of this habit are finely adapted for relieving the monotony of a heavy sky outline. What a charming effect is produced by even a group or two of the Hollyhock, peeping forth from amongst a heavy mass of flat-headed shrubs! The Lombardy Poplar too: who has not seen and admired this tree, rising in the distance in conjunction with the steeple of some time-hallowed church? This is indeed a most important section. If I remember right, Mr. Repton affirms that spiry trees are well adapted to the Grecian style of architecture.

Columnar.—Here are many admirable things, particularly suitable as accompaniments to buildings. For the margins of promenades, terraces, or indeed any long, straight, and formal walks or lines—the corridor, balustrade, &c.—they are considered well adapted. I need only point to the Irish Yew, Arbor vitæ, Red Cedar, with some of the members of the Juniperus and Cupressus families, as peculiarly of this class.

Fastigiate.—There are some singular-looking things in this section; as for instance the upright or Cornish Elm—indeed, some of the Conifers may be placed here. There has been some difference of opinion as to the use of the Lombardy Poplar, which is perhaps more of the columnar character; but I think any one going from London to Richmond by water must be struck with the extraordinary effect produced at some villas on the banks, in the grounds of which the Lombardy Poplar, the Cedar of Lebanon, and the Weeping Willow may be seen in close combination with buildings of modern style; the whole producing a most striking picture; such forms powerfully contrasting with the beautiful river to complete the scene.

Horizontal.—The ancient Cedar of Lebanon may here be placed foremost: too well known to require description. The Cedrus Africanus will probably stand in this class; and that

ponderous and dignified-looking tree, the Araucaria imbricata; the Silver Fir, and indeed several Conifers belong here, which altogether is a most important class, especially with reference to architectural lines and forms.

Weeping Kinds.—First the old Salix Babylonica, or Weeping Willow, which may stand as the type of this class of trees; albeit we have such graceful things as the Cupressus funebris, the Deodar, the Hemlock Spruce, &c.; even the Birch in some of its best humours swells the list, which, if space would permit, might be enlarged with many a goodly candidate.

Who would refuse the Deodar and the Weeping Willow a place contiguous to water scenery? The latter is so much at home in such a situation, that an ornamental piece of water in a pleasure ground is scarcely considered complete without it. Here previous associations and individual aptitude combine to press this time-honoured tree on the notice of all lovers of the graceful.

Having thus given a hasty sketch of character in trees, a subject which, if done justice to, would fill a book, I may now be permitted to point to a few trees or shrubs, which, although possessing much character, may not fall in strictly with any of the classes here assumed.

Conifers in general: it is almost superfluous to remark that they possess capabilities of giving quite a new tone to British scenery; not that they will by any means cause us to part with our majestic Oaks, our Beeches, &c. On the contrary, they will add power to existing groups of deciduous timber trees, by depth of contrast; and combine as it were the freshness of spring with the gloom of winter.

Amongst these the Deodar seems by general consent to occupy the very first place, based upon a double consideration; its exceeding great beauty as a tree, and the well known durable character of its timber. Another capital feature belongs to it, the power of its leader to resist frost or cutting winds. No person on first observing its graceful and delicate-looking leader, growing so late in the autumn, could suppose that it could remain unscathed through a severe winter. It is moreover the most manageable Fir I have seen, as to habit; it would be easy to keep it in a dwarf state for many years. It is thus adapted to rock work or other rustic affairs, where pendent forms are employed. Next the regal-looking Araucaria—a tree for palaces. Cryptomeria, too, and the Douglas Pine, and then the genera Cephalotaxus, Libocedrus, Juniperus, Taxodium, Cupressus, &c. What a rich group! Any painter who, by anticipation, could produce a landscape on canvas, such as will be obtained in Britain in some twenty or thirty years hence by the

use of these fine things, would perhaps give a greater impulse to planting than all the advertising of the tradesmen.

The selection of trees and shrubs possessing autumnal tints is by no means an unimportant part of the planter's business. When the gloom of winter threatens—when the aspect of our gardens becomes totally changed by the general decadence of the floral tribes, then the bounteous hand of Providence, by a gracious compensation, "lights up" the woodland, the grove, and the shrubbery by those delightfully various and ever-changing tints which all who can appreciate the beauties of the landscape so much admire.

This is a numerous section, and any one who would watch and carefully classify them would do planters a real service. I may just observe, that the most glorious tints I am acquainted with are those of the Liquidamber, the old yellow Azalea, and I am tempted to add, although somewhat out of place, the true West's St. Peter's Vine. The Oak family are not poor in these things; the old Merry tree is sometimes beautifully tinted; so is the Corylus atropurpureus, the Hippocastanum, and a host of others, including pure yellows, as the Tulip tree, &c. To these may be added for their rich tints our coloured stemmed shrubs, as some of the Dogwoods. The Berried race may also be glanced at. Foremost the old Holly, associated in the mind with the Christmas festivities of centuries, and outdoors second to none in the richness of its embellishment, or as shelter, whether in the shrubbery, the field, the park, or the forest. Next the sombre Yew, with its funereal associations, combining massiveness, durability, and hardihood. The Arbutus, Juniper, Leycesteria, Snowberry, Ivy, Mahonia, the Garrya, Euonymus, &c.

The Variegated section is by no means meagre or inapt for decorative purposes. Materials also for rock work, or for imparting a wilderness character, undergrowths and climbers; and lastly, as a consideration worthy the close attention of every one engaged in ornamental gardening, our very early spring flowering shrubs or trees, and our very late ones.

Amongst the former I would point to the old snowy Mespilus, the Almond, Ribes, the Corchorus, Chimonanthus, Cydonia japonica, Mezereon, Cornelian Cherry, Weigelia, Forsythia, &c. Amongst the latter, the old Althæa frutex, Erica herbacea, Clethra, Arbutus, Escallonias, Laurustine; and lastly, the old Glastonbury Thorn of legendary fame; and difficult it is to know whether to class this with the old year or the new.

Sketchy as the present remarks necessarily are, as applied to a subject having such wide bearings, it may be seen by those unacquainted with our trees and shrubs, how rich England is in materials for decoration, at whatever period of the year, or what-

ever the style: and I may be allowed to express a hope, that all intent on beautifying their gardens, parks, &c., will take into consideration the propriety of paying a due regard to the habitudes and adaptabilities of trees and shrubs.

XIV.—*Some Account of a New Level.* By A. Forsyth, C.M.H.S., St. Mary's Church, Torquay.

(Communicated April 28, 1852.)

I NEED not say one word on the importance of the plumb-rule and level; they are essentially necessary in ground-work, and indeed in all the operations of horticulture they play a prominent part.

Persons employed in other branches of industry have implements peculiar to their trades: the cooper would not be able to do his work with the cabinet-maker's tools, and the mason would be puzzled to keep his work right with the surveyor's swing level and graduated staff. In the various divisions of labour, therefore, every class clings to its particular character of tools, and as new branches are introduced fresh implements must be had.

Having been accustomed to gardening from my infancy, I may take some credit at this time for knowing what tools may be required for the ordinary operations of horticulture; and, not to tire the reader with a useless list, I will confine my observations to the point at issue, and state what difficulties I have experienced in getting things true to the horizontal and the vertical lines. For example, we shall suppose that five thousand stakes of various sizes, from 4½ feet to 10 feet in length, are to be inserted in the ground by the gardener in one month, viz. the month of May, as props for Hollyhocks, Dahlias, Roses, &c.; these stakes, being neatly planed and painted, are stuck up quite naked, a forest of green sticks, and they are contiguous to the main-lines of walks, where highly educated parties are constantly passing: now, I would ask, could a handy man, with rule of thumb, do this neatly? He could not. This is no fancied case; I have tried it with good workmen, I have tried it myself; it could not be done. I had to get the plummet, and stand by the pole, and first set it right from south to north, and then from east to west, and this in windy weather is not a very straightforward job.

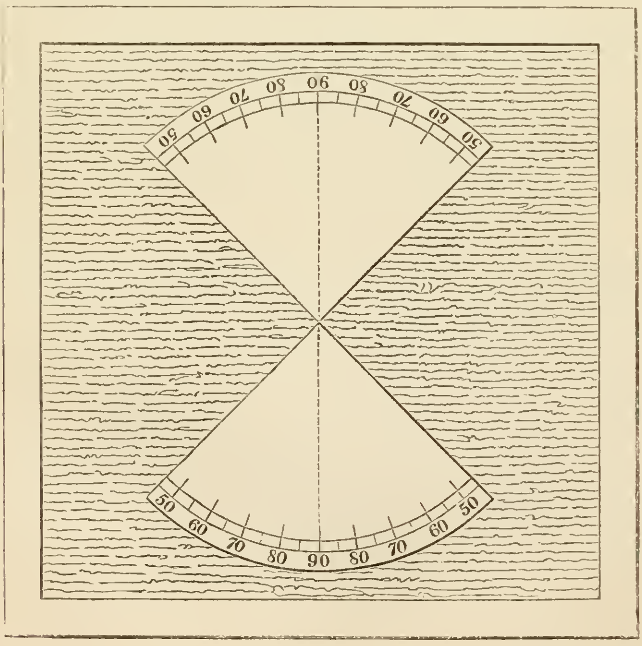
Again, in plunging Pine-apple pots in a bark-bed sloping to the south, it is not very easy even for a practised eye to put them level, and, if they are not, the water will flow over one side and leave the other dry. I need not adduce further instances: these two examples may suffice, as they are taken

from real practice in the ordinary routine of flower and kitchen gardening.

The Level I have invented combines the plumb-line and the level in the same instrument, and that instrument so small as to be got into the pocket; with it a stake may be set upright in any weather, and the vertical line determined instantly; ten observations may be made with this tool whilst the mason's plumb-rule is being adjusted to make one; and the same may be said of the horizontal line, for it is no easy matter to get the spirit-level accurately adjusted; and that most valuable tool, the mason's level, is miserably slow in its movements in all weathers, and in windy weather it will not give a true line at all, whereas this little implement not only tells instantly when the bed is level on which it lies, but tells how far it is from that point in case the bed be an inclined plane, thereby giving a regular fall to drains, &c., where inclined planes are wanted.

The Level is constructed upon the principle of the hour-glass, and, by a particular character of sand, the lines are given very fine.

The accompanying sketch will give an accurate idea of the dial of the contrivance. No scale is needed, as the sketch is the full size of the instrument.



The first was made three years ago; the subject has been carefully digested since, and it is to be hoped that this will prove a most valuable implement in the ordinary operations of horticulture long after the inventor has been forgotten.

In appearance the instrument is something like half a brick. Its dimensions are $3\frac{1}{2}$ inches $\times$ $3\frac{1}{2}$ $\times$ $1\frac{1}{2}$.

The diagram represents the face of it, in which two cavities are cut out so as to form each a quadrant of a circle, as appears by the degrees marked. Some fine sand, like that used for hour-glasses, is enclosed in these cavities by glazing in front. The sand falls from the upper part through a small hole into the lower, as in the common hour-glass. The particles of sand fall so continuously that they form in appearance a tolerably fine line. If the instrument be placed upon anything that is truly horizontal the sand will fall, as a plummet would, from the small hole in the centre, to 90°. But should the instrument be placed upon anything that is not level, the particles of sand will still fall perpendicularly, in accordance with the law of gravitation; but the apparently continuous line of falling sand will not be direct from the centre to 90°; it will deviate from the latter point in proportion as the object on which it may be placed deviates from being level. If it should be placed on the slope of a rafter making an angle of 20° with the ground, then the sand will fall from the centre to 20° from the point at 90°.

Again, if the instrument be placed with its *side* against an upright post or stake, the sand will be seen falling in a line from the centre to 90°; if the post be not perfectly upright, then the perpendicular stream of sand will be seen to fall on points more or less distant from the line at 90°, according as the post is more or less out of the perpendicular.

In using this level for draining purposes, or for other inclined planes, such as setting a melon-frame up to the sun so that its roof may be of the same pitch as an adjoining pine-pit, first put the level upon the rafter of the pine-pit or other inclined plane to be copied, and mark the sand line, which we shall suppose to indicate 75°; then put the level on the rafter of the melon-frame, and prop the frame until the sand line indicates the same angle. And so of drains or other inclined surfaces, putting the level on a piece of wood with parallel edges (a common straight edge).

The level, if made of our Devonshire madrepore marble, is expensive; but, for ordinary purposes, the instrument does very well made of oak or other well-seasoned wood.

XV.—*On Garden Walks.* By R. Glendinning, F.H.S., Member of the Royal Agricultural and Botanical Society of Ghent.

(Communicated May 15, 1852.)

The comfort and enjoyment of a garden, especially in our moist climate, depend in a great degree upon the condition of its walks; for unless these are smooth, firm, and dry, they can scarcely be passed over during a large portion of the year except in very fine weather, and rarely indeed by invalids, more especially at those times when gardens are most enjoyable, viz. mornings and evenings, as well as after showers. A main feature in the formation of a garden should therefore be walks so made that they could be walked on in all weathers with comparative comfort.

In forming walks, the first thing is to determine the position of the verges. In doing this it must be kept constantly in view that in nearly every case, whether on level ground, ascending or descending inequalities of surface, the verges at right angles across the walk should be on the same level, and for the following reasons. *First*, each half of the walk will receive only its due proportion of rain, which tends in so many instances to disfigure and disturb the surface; *secondly*, walks so made will be found more agreeable to walk on than if they had an inclination from one verge to the other; and *lastly*, by this arrangement the eye of taste will neither be offended nor annoyed. The mind will receive that kind of satisfaction which it derives from looking at a perfect architectural elevation, and to effect this appears to me equally important in matters of gardening as in those of building, especially where the utmost refinement in the art is aimed at.

The next point to be considered is to make provision for carrying off water, and this should be so contrived as to meet the maximum amount of our atmospheric precipitations, particularly where the inclinations are rapid and of great length; on level surfaces and when the natural soil is loose and friable, this will not be so urgent, provided the walks are otherwise properly formed. The best material to use for conveying the water will be the earthenware tubing now so well known everywhere, and of a diameter in proportion to the width of the walk and the length the water may have to run before it is discharged. This will be easily determined by persons accustomed to such matters, or at all acquainted with draining. The most convenient place to lay the tubing will be in the centre of the walk, with communicating tubes to the sides, where square cesspools about

9 inches square and 18 inches deep, built in brickwork, should be formed to receive the water and sand or other earthy matters which may be carried along with it. The water will pass into the drain near the surface of these cesspools. A grating fitted in a stone frame must be placed over each cesspool, so that by lifting up the grating the cesspool may be readily cleaned out; where the walk takes a precipitate fall, and for a considerable distance, provision must be made for the water to run in before it reaches the gutters, without allowing it to rut the gravel. This can be effected by means of surface guttering both sides of the walk with tiles made for the purpose, or where sea pebbles abound these may be used with good effect. One of the main points which conduces so largely to the beauty of a garden is the perfect keeping of the walks, and unless precautions are taken in their first construction to guard against those natural and unavoidable causes which disturb the surface, there must be continual repairing and unsightly patching, producing at best a most unsatisfactory result, which a little extra trouble in the first instance would have effectually obviated.

The material of which walks should be formed is a subject depending in some measure upon the geological formation of the neighbourhood; for where the most fitting material is not readily accessible, few are inclined to incur the expense of distant carriage, although railroads have in many instances assisted in this matter. In nearly every part of the country some kind of rough and hard material can be had, such as broken stones, rubble, or even clinkers constitute a good foundation. Walks for ordinary purposes do not, as some imagine, require a great depth of bottom beneath the fine gravel which constitutes the finish; 9 inches in most cases will be found ample. This foundation has been mistaken by many for drainage, but no such thing is meant, as the surface of the walk when finished ought to carry the rain to the sides; as little as possible should be absorbed by the gravel, because where there is great traffic, in a short time the walks would become a complete puddle, and hence the necessity of rendering the surface impervious to wet. This has induced many persons to cover the tops of their walks with concrete or asphalte, but when good gravel can be procured at a reasonable expense, I think under all circumstances it is to be preferred. It is more congenial to our feelings and harmonises better with the surrounding scenery of the garden. Under particular circumstances necessity will suggest other expedients, but then let necessity also justify their use. Two inches of fine screened gravel are sufficient wherewith to cover the surface as a finish to the whole, and where this is found to be an expensive article, one inch

carefully laid on will suffice. Therefore when the cost of a cubic yard of gravel is known, it will be easy to ascertain exactly the expense of coating any given extent of garden walks.

I shall now direct attention to the form which the surface of walks should have when finished. This I apprehend has been but little understood by those who have attempted to lay down rules for our guidance, inasmuch as certain requirements, as well as peculiar situations, have a considerable influence in the matter.

Perfectly level walks, like the floors of a house, are not only more agreeable to walk on, but they are also strictly in conformity with good taste in geometrical gardening, where sculptural and architectural decorations prevail, and indeed in all kinds of gardening; the only plea that can justify a deviation from this rule is, that our garden walks are exposed to the atmosphere, while the floors of our houses are protected. To render walks available therefore for the purposes for which they are introduced, becomes a matter of primary import, otherwise the level rule might be made absolute, as is the perpendicular in the elevation of a building. Now on terraces surrounding buildings, and in elaborate parterres similarly or identically circumstanced, the nearer the walks approach a level surface, just in proportion will a mind imbued with taste and a correct eye appreciate their execution. Walks so laid down are only available in perfectly dry weather. Situations which are elevated, either naturally or artificially, and thus rendered perfectly dry, afford the best opportunities for a close approximation to this rule. It must be stated also, that even in situations where the traffic over them is considerable, they will soon cease to afford either comfort or enjoyment. Necessity, therefore, compels the adoption of a surface less or more convex as the circumstances may appear to demand. Walks in private gardens are little used in wet weather, and therefore they are not likely to be much disturbed at such a period, which is the time above all others when excessive traffic breaks up their surface. The water does not pass off, but is held in the loose gravel until they become almost impassable, which is in fact the case in all public walks so constructed, as was formerly notoriously exemplified in the Society's Garden on wet exhibition days previous to their being altered. It therefore becomes clear that situation, and the uses for which walks are required, should materially influence the operator as to the proportion of convexity which they should receive.

Some entertain an idea that walks should only maintain a very subordinate position in garden arrangements, that they should be kept as much as possible out of sight, and that their appearance

should be only a matter of necessity; but such notions are only applicable to garden *wildernesses*, and have no relation to gardening as an *art of design*. It might be urged, with quite as much consistency, that the door of a mansion should be hidden or obscured, being only a means to an end. Those at all acquainted with the classical and decorative style adopted in some of the best examples of Continental gardening will readily understand this, where indeed walks constitute quite as important a feature in geometrical gardening as windows do in the elevation of a building; they illustrate in fact a material part in the composition. Divest a garden of walks, and the main lines which mark out its form and proportions are destroyed. As roads are to a country evidences of the degree of its civilization, so walks in a garden are indications of the amount of artistical skill brought to bear upon it. Take as an example a garden planted with all possible taste, and with the most decorative flowers which can be selected, and I would ask what satisfaction could such an arrangement produce in a mind cultivated and refined by a high social position, or how could such a garden be enjoyed? Walks contrasting with turf and flowers, conduce to a harmony in the composition which the two latter of themselves never could accomplish. Where artistic gardening has been carried to the utmost limits consistent with propriety and good taste, and where numerous architectural and sculptural embellishments have been introduced, walks are then frequently elevated above the general level. To accomplish this, stone edgings have in some instances been used, and in others, where the style admits of more elaborate embellishment, walls of solid masonry as edgings have been employed in order to raise the walks above the level of the garden, so that the eye may look down upon the flower beds, and more perfectly view the general arrangement and design.

It has been attempted by some to lay down rules as to the direction which walks should take, and also their width; such, however, can be of little service, as local circumstances must nearly in every instance determine this. It may be stated, however, as a principle, that where walks take a straight direction and are level, or upon a uniform inclination, the width must bear a relative proportion to the length; as for example, a walk 10 feet wide may look very well if the length does not exceed 200 feet, but supposing it to be 2000 feet, the proportion would then be entirely destroyed. These, and other matters of detail, must be left to the operator.

XVI.—*Note on Rivers's Seedling Eliza Strawberry; and on a mode of Potting.* By R. Thompson.

Three plants of this were received from Mr. Rivers, October 8th, 1851, in order to ascertain the effects of a particular mode of potting the runners. This consists in ramming the soil in the pots with the view of condensing in the latter a greater quantity of nourishment for the plants.

The above were placed along with the other strawberries potted in the usual way for forcing. Under the same circumstances the Seedling Eliza ripened about a fortnight later than Keens' Seedling, therefore it cannot be recommended for early forcing. The fruit is middle-sized, somewhat conical; flesh solid, with the flavour of Myatt's Eliza; the scapes and footstalks very hairy. It is likely to prove a rich-flavoured strawberry in the open ground.

Hard potting produced no beneficial result. Plants of Keens' Seedling potted in the usual way made a better growth, and yielded a larger crop; and when turned out of the pots after forcing the roots were sound; but many of those in the hard potting were not so.

If we put into each of two pots an equal quantity of the same kind of soil, and if by ramming we can make one pot contain the same quantity of soil, and of course all the nourishment that was in the two, it would seem to follow that a plant would thence derive a double amount of nourishment, and make a proportionate growth. But the experiment proves that such is not the case. It shows, on the contrary, that a large quantity of nourishment may be unavailably contained in soil that is too compact for the roots of certain plants to penetrate. This is more especially the case as regards plants in pots, because they are induced to make finely divided roots, like a net-work, between the sides of the pot and ball of earth. All below the surface, the ball is often completely enveloped with these very fine roots, which bind it more and more, whilst they seem to have lost the power of re-entering it. They assume the character of roots formed in water, and losing the stronger form which those have that travel in the soil, they necessarily avoid the latter, if not of a very permeable nature. The roots of large trees will traverse a great extent of very firm soil, and will sometimes even upset walls that have shallow foundations; but let these powerful roots dip into a well, and then their earth penetrating adaptation ends. They form there, a mass of thread-like roots, that may be bundled up like a quantity of rope-yarn. In like manner, but in a finer degree, the roots of plants in pots form fibres in the moist easy medium o. extension along the insides of the pots; and if it is desirable that

they should not in this way almost entirely desert the soil, it is certainly necessary that the latter should not be rendered, by any means, too obstructive to their ramifications throughout its mass.

I may take this opportunity of adding a word respecting

Cuthill's Black Prince Strawberry.

Runners of this sort of Strawberry were ordered to be potted last summer for the purpose of trying its merits for forcing. The plant is naturally of slender growth, too much so for throwing up a sufficiently strong scape in forcing. Its setting is very precarious; but it is a little earlier than Keens' Seedling, yet it is in every other respect so inferior to the latter, that it cannot be recommended. It has neither size, beauty, nor flavour to render it worthy of room in a forcing-house.

XVII.—*How to form an Asparagus Bed.* By Peter Kendall, Esq., F.H.S., of the Marine Villa, Aldborough, Suffolk.

On forming a new vegetable garden at my residence here about four years since, I made of course a new Asparagus bed, and finding it quite answer my expectations as to its productiveness and quality, and the plan I adopted being original, I send you the particulars of its formation.

I set out my bed as follows:—

60 feet long,
5 feet wide,
4 feet deep.

The earth was all taken out and laid on one side the bed; I then placed at the bottom 2 feet deep of salt ooze, from the banks of the Alde: $1\frac{1}{2}$ feet deep of the river weed (a long grass): 2 feet of the best vegetable mould was then placed on the top, and the young plants set out at 18 inches distance, all over the bed.

Note by the Vice-Secretary.—It will be obvious that the method of proceeding adopted in this little experiment was founded upon the most just conception of the nature of the Asparagus plant. Deep rich loose soil for its roots, salt in moderation, and the crown of the plant only just buried in earth, produced, as might have been expected, heads of the finest Asparagus possible, green, succulent, excellent in flavour, and in no respect inferior to any that has been seen by the most experienced gardeners.

XVIII.—*A Note on the Protection of Fruit Trees against Walls.* By R. Thompson.

With reference to the protection of Fruit trees, it may be of utility to state the means employed in the late unusually severe weather, and the results.

In March the nights were generally frosty; the wind during twenty-four days came from north-east or east, dry and cold, so that vegetation was fortunately much retarded. In April, the wind still continued to blow from cold quarters, and the dryness of the air increased so that there was not sufficient vapour to form clouds to prevent the escape of heat by radiation; and the consequence was, that on the nights of the 19th and 20th of April, the thermometer indicated, respectively, 12° and 11° below freezing. According to the register kept at the Garden, this was lower than had been registered for twenty-six years so late in April; and it appears from Howard's "Climate of London," that so low a temperature has not occurred so late in the season within the last fifty years.

Peaches and Nectarines were in full blossom at the time. In the end of March, coping-boards were placed along the wall, and also a net over half of it, and straw screens were placed against the trees on the other half at nights. But previous to the severe nights abovementioned, the net was removed, and straw screens, deemed better protection, were substituted. These screens consisted of one length of the straw fixed on twine stretched between inch-square 6 feet long training-rods. The screen was kept stretched by placing the tops of the rods *a a* against nails in the wall, whilst the lower pointed ends were in the ground. During the day the screens were rolled up and laid at the bottom of the wall. So far as these extended, the blossoms were sufficiently protected; but all blossoms on the fronts of the shoots above them were destroyed. Some, however, that were on the sides of the shoots, and leaning close against the face of the bricks, derived as much heat from the latter as kept them alive. On the whole a fair crop has been saved.

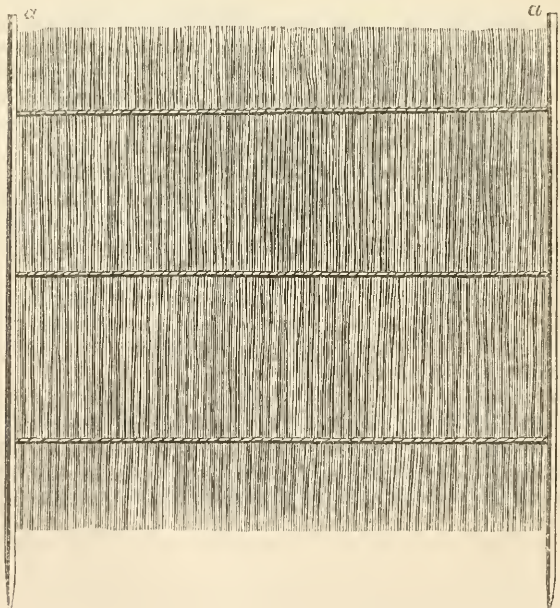
On the Pear walls the blossom was abundant and mostly expanded. Coping-boards were procured for a considerable portion of the walls that were originally furnished with brackets. In addition to the coping-boards a net was suspended in front of the trees on the east aspect; and elsewhere straw screens were made to project from the top of the wall. Under these the fruit on the upper branches near the straw were saved, but those towards the bottoms of some of the trees were much injured. With few exceptions, however, the crop of pears on walls will be good.

A glazed Peach frame was covered with mats; but, notwithstanding this precaution, the blossoms were in great measure cut off.

The iron and glass protecting frame by Messrs. Cottam and Hallen was not completed when the severe frost was experienced. The foliage under it is at present (June 1) very healthy, and does not appear checked like that exposed to the cold nights in the end of May.

From what has been observed, the facts are ascertained that a thin straw screen will protect peach-trees in blossom from the effects of twelve degrees of frost; that coping-boards will be sufficient for about four degrees; that a common net (not woollen), aided by coping-boards, was insufficient compared with straw screens; that sashes, in a nearly horizontal position, covered with a mat, but with a 3-inch opening at the back of the frame, and a perforated zinc plate in front, were likewise insufficient, the peaches suffering as much, or more than those on the open wall with coping only.

Straw having proved so efficient, probably owing to its being hollow, and, confining in its interior a quantity of air, a slow conductor of heat, it seems desirable that it should be manufactured so as to preserve, in great measure, its tubular form, and have a neat appearance.



ORIGINAL COMMUNICATIONS

XIX.—*Recent Researches on the Respiration of Plants.* By M. Garreau, M.D.*

In the course of my first experiments upon the absorption by and exhalation from those surfaces of plants which are exposed to air, I had often noticed that the leaves and green parts of plants, when acted upon by the direct rays of the sun, gave out very sensible quantities of carbonic acid.

This fact, so apparently opposed to the ordinary notions respecting the functions of leaves, struck me very forcibly, especially as it is also precisely under the direct influence of the sun that the leaves and young shoots of plants reduce the carbonic acid in the atmosphere with the greatest rapidity and retain the carbon.

Some more recent experiments made in the latter part of 1850 (*Annales des Sciences Naturelles*, 1851) not only confirmed my former observations, but showed that expiration of the acid gas takes place equally in the shade if the temperature is sufficiently high to cause the vital juices of the plants to move. These experiments being made towards the end of the summer, did not enable me to ascertain whether the phenomena which I have mentioned were affected by the age of the plants or the seasons, and for the purpose of acquiring further information upon this subject the experiments about to be described were made.

1. *The Action of Buds on Atmospheric Air.*

Buds, like young plants, represent individuals at a time when the living substances containing proteine are, comparatively speaking, much greater than at any other time of their existence, and it became interesting to ascertain whether the activity of their respiration bore any ratio to the quantity of their animal matter.

In order that the results might be as exact as possible and easily compared with each other, the degree of the developement of the buds, and their weight both when fresh and dried, were noticed with the greatest care, as was also the quantity of air in which they respired, which was always kept as nearly as possible at the same temperature during all the experiments.

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* Annales des Sciences Naturelles, xvi. 271.

The buds, selected from amongst the finest and cut with a small disc of the branches bearing them, were made up into a little bundle in such a way that the small discs formed a support which could be plunged into water and yet leave the buds unwetted. A cup of water with the buds thus arranged within it was placed under a graduated bell-glass, the inside of which had been previously covered with a concentrated solution of hydrate of potash in order that the carbonic acid might be fixed at the moment of its escape; the bell-glass and the cup within it were then put in a dish of water placed near the window of a room the temperature of which was kept at 15° or 16° C. during the twenty-four hours for which the experiment lasted. The buds did not suffer the least under these circumstances, and whilst under the glass their little scales expanded, and the size of the small leaves lying immediately below the scales of the strongest buds, as those of the *Ribes*, *Tilia*, *Staphylea*, &c., was doubled.

The diminution of the volume of air was noted separately, day and night; the temperature being the same, this diminution very nearly expressed the volume of carbonic acid given out; for it had been previously ascertained that the air was condensed by the buds only to a very insignificant extent.

The experiment over, the buds were separated from the small discs which supported them, weighed when quite fresh, then dried for twelve hours at a temperature of 110° C., and weighed dry.

The annexed table (p. 211) shows that in equal times and temperatures buds consume on an average twice as much carbon as fully developed leaves. This accounts for the fact, that in the buds and their vicinity M. Dutrochet was enabled to determine in a most marked manner the temperature peculiar to plants, and to generalize the discovery of their paroxysm made by M. Ad. Brongniart.

If the numbers in the three last columns be compared, it will be seen that as a general rule, and under the conditions mentioned, the buds exhale about eight times their volume of carbonic acid in the twenty-four hours; that dried at a temperature of 110° C. they lose on an average five-fourths of their weight, a loss which represents their water of composition and of vegetation, and that then the carbonic acid exhaled is to the volume of their solid parts as 40 to 1, if we admit, as we may with considerable accuracy, that in this state their density is the same as that of water.

Theodore de Saussure was satisfied with establishing the relation in volume which the carbonic acid expired by leaves bore to their weight when fresh. In our opinion no exact results

PLANTS EXPERIMENTED UPON.	Dates — Mar.	Temperature, C.	Volume of Air.	Weight of Fresh Buds.	Weight of Dry Buds.	Acid exhaled during 24 hrs.	OBSERVATIONS.
		°	c. c.	gr.	gr.	c. c.	
1. *Syringa vulgaris*, 12 buds.	27	15	600	9·0	2·00	70	18 c. c. of carbonic acid exhaled by day. These buds unfolded their little leaves during the experiment.
2. *Æsculus macrostachya*, 5 buds.	27	15	600	7·0	0·85	45	12 c. c. of acid were exhaled by day. Leaves unfolded before the experiment began.
3. *Sambucus nigra*, 6 shoots.	27	15	600	10·0	1·75	60	10 c. c. of acid exhaled by day.
4. *Ribes nigrum*, 10 shoots	27	15	600	7·0	1·25	60	12 c. c. of acid expired by day. The surface of the leaves doubled during the experiment.
5. *Euonymus latifolius*, 10 buds.	28	15	700	5·6	1·15	44	14 c. c. of acid exhaled by day. Scales remained imbricated after the experiment.
6. *Pavia rubra*, 11 buds.	28	15	700	9·0	1·45	56	13 c. c. of acid exhaled by day. Scales remained imbricated after the experiment.
7. *Staphylea pinnata*, 14 buds.	28	15	700	6·5	0·90	52	15 c. c. of acid exhaled by day. Buds expanded at the apex.
8. *Lonicera alpigena*, 15 buds.	28	15	700	5·3	1·00	49	15 c. c. of acid exhaled by day.
9. *Corylus avellana*, 23 buds.	28	15	700	5·6	1·50	58	18 c. c. of acid exhaled by day. Buds half open.
10. *Tilia Europæa*, 3 buds	31	15	700	4·0	0·70	46	24 c. c. of acid exhaled by day. The leaves began to come out of the scales.
Æsculus Hippocastanum, 20 buds.	29	14	700	13·5	2·50	90	45 c. c. of acid exhaled by day.
Æsculus macrostachya, 5 buds.	29	14	700	7·0	1·20	36	10 c. c. of acid exhaled by day. Leaves unfolded.

can be arrived at in this way, since the quantity of water of vegetation contained in plants varies with the time of day, the season, their age, the places in which they grow, and the temperature to which they are exposed. Besides, as soon as an attempt is made to determine the relations which exist between the matters containing proteine and the oxygen transformed by them into acid gas, all comparison is liable to lead to erroneous conclusions unless based exclusively on the weight of the organ dried at a temperature which is kept uniform in all the experiments ; for this reason the buds upon which the present observations were made were dried for twelve hours at a temperature of 110° C.

These first experiments upon the respiration of buds were scarcely finished when the temperature fell rapidly, and their vegetation remained stationary until the 15th of April, when it again became very active, the temperature in the shade having risen to 15° and 18° C. On the 20th of the same month each of the buds of the trees previously examined had made a young shoot, and these shoots were in their turn taken and made up into little bundles, of the same weight as that of the bundles of buds before mentioned, and placed under the same conditions as the latter. The results were very analogous to and sometimes identical with those obtained from the buds ; this will be seen if the numbered examples in the following table (p. 213) are compared with the corresponding numbers in that before given.

If, instead of comparing the partial results given in this table, we take the mean as term of comparison, the differences which will be then found to exist are so small that we feel warranted in stating that the buds and young shoots which succeed them, consume, under the same conditions and for equal weights, an equal quantity of carbon : that is to say, that the activity of their respiration is the same. We have in effect,—

Table the first: 69 grammes; fresh buds = 12·55 grammes; dry buds = 240 c.c. carbonic acid.

Table the second: 66 grammes; young shoots = 12·85 grammes; dry shoots = 266 c.c. carbonic acid.

2. *The Respiration of Young Plants.*

Seeds, like buds, contain the fundamental rudimentary organs of the plants which they spring from, and are provided with a large proportion of living azotized matters : thus it is that during their germination, if collected into masses, they consume their own carbon, and give out sufficient heat to affect the commonest thermometers. This function, already so active at the commencement of germination, goes on with still greater intensity when the seeds, disengaged from their episperm, spread out their cotyle-

NAMES.	Dates — April.	Temperature.	Volume of Air.	Weight in a Fresh state.	Weight in a Dry state.	Acid exhaled after 24 hrs.	OBSERVATIONS.
		°	c. c.	gr.	gr.	c. c.	
1. *Syringa vulgaris*, 6 shoots.	18	15	700	9·0	1·70	76	
2. *Æsculus macrostachya*, 4 shoots.	18	15	700	7·0	1·10	45	
3. *Sambucus nigra*, 3 shoots.	18	15	700	10·0	1·90	62	
4. *Ribes nigrum*, 4 shoots	18	15	700	7·0	1·40	61	
5. *Euonymus latifolius*, 8 shoots.	18	15	700	5·6	1·15	56	
6. *Pavia rubra*, 7 shoots	18	15	700	9·0	1·35	70	
7. *Staphylea pinnata*, 13 shoots.	18	15	700	6·5	1·15	67	
8. *Lonicera alpigena*, 7 shoots.	18	15	700	5·3	1·10	50	
9. *Corylus avellana*, 8 shoots.	20	16	700	5·6	1·30	46	
10. *Tilia Europæa*, 5 shoots.	20	16	700	4·0	0·70	33	
Tilia Europæa, 5 shoots .	20	16	1200	4·0	0·70	33	
Corylus avellana, 9 shoots	20	16	700	5·6	1·30	46	

dons to come into still closer contact with the air which surrounds them.

To measure the activity of the respiration of young plants, some seeds were sown, from the 12th to the 16th of April, in very fine siliceous sand moistened with rain-water, and placed in glass capsules. After germination the episperms were carefully removed, and the glasses with the vegetating plants were placed under a bell-glass as before. After having carefully measured the diminution of the volume of air, the young plants were taken with their radicles, washed in a little stream of water to get rid of the sand attached to them, wiped, weighed, then dried at a temperature of 110° C., and weighed again. The following table shows the conditions under which the experiments were made, and the results obtained from them:—

Names of Plants.	Dates — April.	Temperature C.	Weight in a fresh state.	Weight in a dry state.	Acid exhaled after 24 hrs.	Observations.
		°	gr.	gr.	c.c.	
Lactuca sativa .	12	16	4·5	0·40	33	Placed in the apparatus 3 days after germination.
Valerianella olitoria.	16	16	4·0	0·20	25	Placed in the apparatus 4 days after germination.
Papaver somniferum.	13	16	5·8	0·45	55	Placed in the apparatus 3 days after germination.
Sinapis nigra .	12	16	8·5	0·55	32	Ditto.
Lepidium sativum	12	16	2·5	0·25	12	Ditto.

Comparing the volume of acid produced with that of the plants containing their water of vegetation, the proportion will be found to be that of 6 to 1, or thereabouts; but if the comparison is made with the weight of the organic matter dried at 110° C., it will be seen that in reality they consume, in the same space of time and in the same conditions, a much larger quantity of carbon than is consumed by the buds; and this might have been expected, inasmuch as the seeds, at an early stage of germination, part with their episperm, which is very poor in animal matters, and their living azotized substances, which form the seat of the respiratory action, are thus relatively increased.

In a former paper (*Ann. des Sci. Nat.*, 1851) I had collected some proofs which are increased by the new facts just related; for now as then it may be seen, on consulting the analytical results given hereafter, that the organic azote contained in the buds, the young plants, and the leaves is abundant in proportion as their

respiratory activity is well marked, or, in other words, and other circumstances being the same, as the oxygen consumed in a given time is greater.

In order that the results might be as trustworthy as possible, the accurate tests pointed out by MM. Warentrapp and Will were employed in the first instance, and afterwards the not less accurate one of M. Millon was used to correct any error that might have escaped notice.

Name of Plant.		Weight in a fresh state.	Weight in a dry state.	Acid exhaled after 24 hours.	Volume of Azote obtained.	Percentage of Azote.	Percentage of matters containing Proteine represented by the Azote found.
		gr.	gr.	c.c.	c.c.		
Syringa vulgaris .	Leaves increased to 3/2	9·0	2·2	50	39·3	2·27	15·14
	Buds (March) . .	10·0	2·2	88	83·6	4·76	31·74
Fraxinus excelsior	Leaves (Sept.) . .	8·5	2·2	40	38·0	2·18	14·54
	Buds (March) . .	11·5	2·2	77	81·0	4·63	30·88
Staphylea pinnata	Leaves (end of Sept.)	9·0	2·2	40	57·2	3·26	21·74
	Buds (March) . .	15·6	2·2	127	101·0	5·76	38·41
Tilia Europaa .	Leaves (Sept.) . .	10·4	2·2	68	57·0	3·22	21·47
	Buds (March) . .	12·6	2·2	140	100·0	5·72	38·15
Small Plants	*Lactuca sativa* . . . *Valerianella olitoria* . *Papaver somniferum* . *Sinapis nigra* . . .	30·0	2·2	168	110·0	6·27	41·82

These results are sufficiently intelligible to render more than one or two remarks unnecessary. It must be observed, however, that the animal matter of the buds, and especially that of the young plants, is much more abundant than might have been supposed, being, in the cases mentioned, no less than from 30 to 40 per cent. It is however possible that some unknown immediate principle, different from the proteine substances, may to a certain extent have furnished the azote which served for their calculation.

But although this may possibly have been so, the results are sufficiently general to lead to the belief that it is not probable. Besides, in the contrary case, the more organic azotized matters generally exist in such small quantities in plants that they would scarcely influence the calculations which have been made.

3. *Exhalation of Carbonic Acid by the Leaves under the influence of the Solar Rays.*

Of all the facts relating to the respiration of the green parts of plants, the exhalation of carbonic acid by the leaves, when acted upon by the direct rays of the sun, is by far the most curious, and worthy of the attention of physiologists. Being most peculiarly organs of reduction, they set free the oxygen of the gas and retain its carbon, under the influence of the sun's rays; and under the very same influence as was ascertained in 1849 (*Ann. des Sci. Nat.*, 1850), they give out a portion of their carbon in the form of acid gas. Since then I have paid more especial attention to the influence of temperature, of shade, and of dull weather, on the respiration of these organs during the day, neglecting for a time that of the direct rays of the sun; and I now lay before the public an account of the observations made by me in this matter during the present year (1851). The experiments consisted in making green branches and leaves of plants, in the open ground, breathe in the limited atmosphere of a tolerably capacious flask containing some baryta-water.

The apparatus consisted of a flask of the capacity of 6000 cubic centimètres. The mouth of the flask, sufficiently large to receive a branch covered with leaves without bruising them, was turned down, and closed with a cork having a groove cut in it to fit the stem. Through the middle of the cork passed a safety-tube, the object of which was first to facilitate the introduction of baryta-water for the purpose of fixing the carbonic acid, and, secondly, to prevent the continual rarefaction of the air caused by the formation and fixing of the acid gas.

Baryta-water was preferred to lime-water, as carbonate of baryta is less soluble than carbonate of lime. The carbonic acid obtained by this means does not however accurately represent all the acid that might have been fixed; for I ascertained that carbonate of baryta is soluble to an appreciable extent in an excess of base.

In all the experiments made in the way mentioned, the herbaceous parts tried were fresh and vigorous, and seldom exceeded in size $\frac{1}{300}$th part of the volume of the confined air in which they breathed. After an exposure to the sun for six hours, the branch was detached from the plant, and the baryta-water agitated so as to fix the last portions of acid gas mixed with the air.

This water, charged with carbonate in suspension, was then collected in a closed funnel, and the deposit was put into a graduated tube, and decomposed over mercury by means of some pieces of citric acid. This acid was preferred to tartaric acid

because the first forms a soluble salt, and acts more efficaciously on the carbonate.

The following table shows the conditions in which the plants were placed, and the volume of acid obtained; but which does not, for the reason already given, represent the whole of that which was fixed.

NAMES OF PLANTS.	Dates.	Weight.	Temperature in the shade, C.	Volume of air.	Baryta-water.	Duration of the experiment.	Acid exhaled.	OBSERVATIONS.
		gr.	°	c.c.	gr.	hours	c.c.	
Fagopyrum cymosum	24 Aug.	15	25	6000	100	12	30	6 hrs. in the sun.
Ficus carica	25 Aug.	30	24	6000	100	12	24	Ditto.
Asclepias cornuti	4 Aug.	26	22	6000	100	12	36	Ditto.
Glycyrrhiza echinata	3 Aug.	10	22	6000	100	6	8	3 hrs. in the sun.
Kitaibelia vitifolia	29 July	19	20	6000	100	3	16	Ditto.
Syringa vulgaris	29 July	19	20	6000	100	3	10	Ditto.

Although the exhalation of carbonic acid under the influence of the solar rays at a certain temperature cannot be doubted, it must nevertheless be admitted that in the young shoots and leaves there exist two simultaneous and opposed actions, one of combustion, the other of reduction, and that the accumulation of carbon in plants can only be explained by the greater effect of the latter as compared with that of the former. New experiments upon this matter were however required in order that this curious subject might be satisfactorily understood, and they have accordingly been made. They were suggested by the following consideration: if plants exhale carbonic acid at the very same time that they reduce it, they ought incessantly to reduce that which they give off if they are in a confined atmosphere. If then two branches covered with green leaves, of the same plant, of equal ages and weights, were placed in two equal atmospheres, one with and the other without a solution of baryta, the glass with baryta-water ought to contain more carbonic acid than the other, inasmuch as the gas would be fixed in the former, and thus not be liable to be reduced by the leaves.

The following table shows the results obtained by actual experiments, and the conditions under which they were obtained.

Experiments to show that the carbonic acid exhaled in a limited atmosphere is reduced in the day time as it is given out by the plant.

	Names of Plants.	Dates.	Weight of the plant.	Air with or without baryta-water.	Temperature, C.	Duration of the experiment.	Acid exhaled.	Observations.
			gr.		°	hours.	c.c.	
1 2	*Kitaibelia vitifolia*	30 July	21 21	without with	18	10 to 4	0 12	Showery weather with a few rays of sunshine.
1 2	*Rhus radicans* .	31 July	25 25	without with	19	11 to 5	0 11	Damp and rather dull weather.
1 2	*Fraxinus excelsior*	1 Aug.	15 15	without with	18	11 to 5	0 6	No sun, rather dull, rain.
1 2	*Acer eriocarpon* .	1 Aug.	30 29	without with	19	12 to 6	24 41	Rather dull.
1 2	*Syringa vulgaris.*	4 Aug.	15 15	without with	18	12 to 6	0 6	Three hours of bright sunshine.
1 2	*Glycyrrhiza echinata* . . .	7 Aug.	10 10	without with	22	12 to 6	0 8	Four hours of sun.
1 2	*Asclepias cornuti*	5 Aug.	26 26	without with	23	7 to 7	7 37	Exposed to a bright sun during 6 hours.
1 2	*Fagopyrum cymosum* . . .	6 Aug.	15 18	without with	25	7 to 7	9 30	Ditto.
1 2	*Ficus carica.* .	6 Aug.	30 30	without with	24	9 to 6	9 24	Ditto.

These experiments, made with the greatest care, show to demonstration that not only the carbonic acid exhaled whilst the plant is exposed to the sun is to a great extent reduced under its influence as the gas is given off, but that this also takes place in the shade even on a cloudy day: this may explain the occasional rapid growth of plants during a long succession of dull rainy days in the climate of Lille. The above experiments were made in the apparatus already described, and in the examples numbered 1 the quantity of gas was ascertained by means of baryta-water introduced through the safety tube as soon as the experiment was over. It is scarcely necessary to remark that in the examples numbered 2, the whole of the gas given off is not represented, some of it having been reduced by the leaves, the surface of which was much larger than that of the baryta-water at the bottom of the vase. It must also be observed that, as is shown in the following table, experiments made in the sun, and in a high temperature, give a larger amount of carbonic acid.

NAMES OF PLANTS.	Weight.	Temperature in the shade, C.	Atmosphere with or without baryta-water.	Duration of the experiment.	Acid exhaled.	OBSERVATIONS.
	gr.	°		A.M. P.M.	c.c.	
1. . . . . . *Fagopyrum cymosum*	15	26	without.	7 to 7	42	6 hours in the sun.
2. *Fagopyrum cymosum*	15	26	with	7 to 7	66	Ditto.
3. . . . . . *Fagopyrum cymosum*	15	26	with	7 to 7	120	Apparatus removed from the direct influence of the light by being placed under a shade open at the top, and furnished with a cover having a hole in it to allow the branch to pass through.
4.	20	26	with	12 to 6	35	This experiment was made in the shade.

The influence of temperature upon the respiration of plants is not doubtful, for the *Fagopyrum* deprived of light, and at a temperature of 35° C., gives out twice as much carbonic acid as it does at the ordinary temperature of a summer's night. The four examples just given serve not only to show the stimulating action of heat on the respiration of plants, but they, or at least the three first, may assist in determining the quantity of carbonic acid exhaled and reduced.

In short, as it has been found that the acid given off by a plant in a confined atmosphere is wholly or partly reduced, it is natural to admit that the three *Fagopyra* of the same weight, and submitted for the same period of time to the same temperature, respired in the same manner, that is to say that they all probably formed 120 cubic centimètres of gas, of which 78 cubic centimètres were reduced by the first number, and only 54 by the second; the difference of 24 cubic centimètres being, I imagine, owing to the action of the baryta-water. This surmise must not however be considered as a decided opinion, for it may happen that in the dark all the acid produced by respiration is completely given off, whilst under the influence of the solar rays, whether direct or indirect, one part of the acid is reduced in the parenchyma of the respiring organ. I am the more inclined to think that this is often the case, because I have occasionally observed that very small quantities of acid escaped reduction. The means employed for ascertaining the reduction of acid exhaled during the day may be also used for the purpose of

observing whether carbonic aeid gas is not reduced during the long summer evenings and mornings. The following table shows the results of some experiments undertaken with this view, and they are given, though, from the small number of the experiments, nothing decided can be inferred.

Experiments which tend to show that the carbonic acid exhaled is partly reduced during the summer evenings and mornings.

Names of Plants.	Dates.	Weights.	Temperature, C.	Atmosphere with or without baryta-water.	Duration of experiment.	Acid exhaled.	Observations.
		gr.	°		P.M. A.M.	cc.	
Fagopyrum cymosum	3 Aug.	25 25	15	without with	7 to 7	42 52	Fine moonlight night.
Fagopyrum cymosum	9 Aug.	15 14	15	without with	7 to 7	42 48	Cloudy sky.
Fagopyrum cymosum	14 Aug.	21 18	16	without with	8 to 8	70 58	Ditto.
Fagopyrum cymosum	31 July	27 24	15	without with	8 to 8	42 46	Fine night.
Acer eriocarpon	1 Aug.	18 18	14	without with	7 to 7	56 60	
Staphylea trifoliata	2 Aug.	8 8	15	without with	7 to 7	6 9	
Gleditschia triacanthus	2 Aug.	8 8	15	without with	7 to 7	15 19	
Rhus radicans	2 Aug.	24 23	15	without with	8 to 8	35 40	

The reduction of carbonic acid being less active in the shade than in the sun, I was curious to learn if the diffused light, occasioned by the eclipse of the 28th of July, caused an increase of undecomposed carbonic acid in the air surrounding the plants. For this purpose four apparatus were got ready just as the moon passed before the sun, and were examined the moment the eclipse was completely over. The experiment lasted for three hours, and the feeble solar rays were almost constantly intercepted by light clouds. The results obtained are given in the following table.

Names of Plants.	Weights.	Acid exhaled.	Observations.
	gr.	c.c.	
1. *Fagopyrum cymosum*	22	7·5	The mean temperature rose to 17°·5 C.
2. *Fagopyrum cymosum*	22	7·5	
3. *Syringa vulgaris* (2 young shoots)	22	8·0	
4. *Kitaibelia vitifolia*.	22	10·0	

In order to complete the experiment the four apparatus were got ready, the next day, at the time at which the eclipse had occurred, and in them were placed other specimens of the same plants and of, as nearly as possible, the same weights as those before used. The sky was clear and cloudless, and the temperature average, but in the shade 2° C. higher than before.

Names of Plants.	Weights.	Acid exhaled.	Observations.
	gr.	c.c.	
1. *Fagopyrum cymosum*	21	10	In the shade.
2. *Fagopyrum cymosum*	21	10	In the shade.
3. *Syringa vulgaris* (2 young shoots)	19	10	In the sun 2 hours.
4. *Kitaibelia vitifolia*.	19	16	Ditto.

From the above it would seem that the eclipse of the 28th of July had no sensible influence on the respiration of plants, and that the smaller quantity of carbonic acid existing when the eclipse was over ought to be attributed to the lower temperature caused by the interception of the sun's rays by the clouds, inasmuch as in the experiments made the next day the difference was greater, as the temperature to which the apparatus was exposed was greater. However, it may be concluded that the temperature being the same, the acid expired would have been more abundant in the diffused light caused by the eclipse; for the reduction of the acid gas is known to be much less intense in the ordinary light of day than in the sun.

If it be inquired how M. Théodore de Saussure, whilst engaged in his experiments on the respiration of plants, happened to overlook the fact that carbonic acid is given off by them, it can only be answered by way of conjecture that in all probability he was so intent upon its decomposition by the leaves when acted upon by the sun, and upon the importance of that great

fact, that he was induced to neglect as trifling all contrary appearances; and this is the more probable as in two instances he noticed its exhalation, without, however, doing more.

It being clearly ascertained that plants decompose carbonic acid, and that they also exhale it, we may fairly infer that the accumulation of carbon is explained by the predominance of the first process over the second; and to show that this is so, the following experiments were made. A top of a young, green, and leafy stem of *Fagopyrum cymosum*, weighing, after the experiment, 15 grammes, was placed in the curved part of the apparatus before mentioned, which was then carefully closed and luted; a small caoutchouc bladder, furnished with a stop-cock, and containing 200 cubic centimètres of carbonic acid, was then fixed to a tube, so that the stop-cock being open there was a free communication between the gas in the bladder and the air in the flask. After an exposure to the sun for six hours, only 75 cubic centimètres of gas were found in the flask and bladder. Whilst this experiment was going on, another, and in every respect similar piece of the same plant, was in a second apparatus with some baryta-water, which fixed 11 cubic centimètres of exhaled gas.

In order to ascertain whether the air in calm weather can by its carbonic acid supply the wants of a plant, notwithstanding the loss of carbon occasioned by the latter, both by day and night, water saturated with baryta and its carbonate, and with a surface of 300 square centimètres, was exposed for an hour in the open air to the rays of the sun; the pellicle which had then formed gave, on being decomposed by citric acid, 15 cubic centimètres of carbonic acid, that is 180 cubic centimètres for twelve hours of day. Now, the surface of the leaves of the 15 grammes of *Fagopyrum* was five times as large as that of the solution of baryta. These 15 grammes were then at least in the immediate contact of 900 cubic centimètres of carbonic acid during the day—*i.e.* 40 or 45 times more than that which might have escaped reduction during exhalation. Besides, the exhalation by the leaves is not really very great, unless the temperature in the shade is 20° C.; at a lower temperature it generally decreases, as does also the reduction, the opposite effects of which it seems destined in part to correct.

Now that the existence of two simultaneous and contrary processes—namely, those of combustion and reduction—is no longer doubtful, the notions regarding the respiration of plants hitherto current must necessarily be considerably modified. Indeed it is clear, that both in the day and in the night plants respire like animals, but that this respiration is during the day more or less concealed by the contrary process: and it was for this reason

that ever since 1849 (*Ann. des Sci.*, 1850) I was inclined to regard what was called the respiration of leaves as two distinct processes.

Plants decompose water and fix its hydrogen; they decompose ammonia and its salts, and fix nitrogen; they reduce sesquioxide of iron in solution to protoxide, and they reduce carbonic acid obtained from the soil, formed in their tissues or taken from the air. All these acts are, in our opinion, closely connected with the functions of assimilation and nutrition, whilst the consumption of carbon and perhaps other elements, which is the principal source of the vital heat of plants, is connected rather with the function of respiration. If we look, then, at the most evident phenomena, the respiration of plants does not differ from that of animals, and instead of the processes being different in flowers, leaves, fungi, &c., they are all identical, combustion of carbon and production of heat, which may itself influence the intensity of the function of respiration, where only a small quantity of the acid produced thereby escapes reduction.

The existence of a diurnal and nocturnal animal respiration in plants ought not to be looked upon as very surprising if it be remembered that those matters whose vital properties are most manifest in plants have life, and are of an animal nature, and, it may be added, become true animals at certain periods of the life of some plants.

Let us take for example the animalcules found in the antherida of *Chara*, *Nitella*, Ferns, Mosses, Horsetails, Liverworts, &c., which have been so carefully examined by MM. G. Thuret, Nägelli, Sumenski, Wigand, Derbès, Sollier, &c., and it will be found that their animal nature cannot be doubted, and that their origin is incontestably owing to the metamorphoses or developement of the living proteine substances of the cells. For my own part, I have observed them in several species of *Chara*, in *Nitella flexilis*, and *Marchantia polymorpha*, and the animal nature of these beings appears to me so evident that, with all due respect to M. Siebold, I cannot help thinking that his observations were made at a wrong season.

Let us examine again the motion of the zoospores, discovered by Meyen, and the organization of which was described by Unger in the *Vaucheria clavata*, and afterwards by Thuret, and the movements of the sporoides of different *Fucaceæ* described by MM. Decaisne and G. Thuret (*Ann. des Sci.*, 1850); and if we do not then believe the living azotized substances which move in the cells of plants to have the organization of animals (as, for example, that of the animalcules in the antheridia, or of the zoospores), we shall be at least convinced that their organizations are remarkably similar.

What is more to the point still, is that the zoospores, actually living and moving, but deprived of the cellular envelope, soon become stationary, and cover themselves with a cell which they secrete; and though to all appearance dead under the veil which hides them from our view, their vitality is still retained, for they form a plant which again calls them into life. This curious fact deserves a most careful examination by physiologists, as it might lead to other circumstances throwing great light on the true nature of plants.

There is in truth an immense difference between algals and the large majority of other plants; but we must look for their resemblances not to form or functions of secondary importance, but to the movements and principal functions of their azotized substances.

Conclusions.

From the facts which have been now mentioned, we may conclude:—

1. That buds when respiring consume more carbon than the leaves, and less than plants themselves. That the quantity of acid expired is great in proportion as the quantity of living proteine matters contained in these organs is great, their weights and surfaces being equal.

2. That in the day time, both in the sun and in the shade, leaves exhale carbonic acid, the quantity of which is great in proportion as the temperature is high.

3. That the acid found in the apparatus does not represent by a great deal all the carbonic acid given off, the larger part of it being reduced after being exhaled.

4. That two simultaneous and opposite actions go on in the leaves, both in the sun and in the shade; one by which carbonic acid is formed, the other by which it is decomposed, and that the accumulation of carbon in plants is due to the excess of the effects of the latter over those of the former.

5. That these two acts being simultaneous, the former ought to be considered as the respiration of plants, and the latter as more especially connected with their nutritive functions.

XX.—*Chinese pinnated Berberries.* By Robert Fortune.

In the earlier volumes of this Journal there are several notes of mine on Chinese plants introduced by the Horticultural Society from 1843 to 1846. Some of the plants noticed then were almost unknown to cultivators in this country, and it was difficult to convince the learned in such matters that they were of much importance. Time, however, often does what nothing else can do. After three more years of travel in the far East, I return to find many of my Chinese pets in high favour, and occupying the places in our gardens which they so richly merit. It is unnecessary now to write of the beauty of such plants as *Dielytra spectabilis*, *Weigela rosea*, *Forsythia viridissima*, *Jasminum nudiflorum*, *Spiræa prunifolia plena*, and many others which need not be mentioned. Leaving these to work their own way in the world, I must now introduce to notice some strangers of no less interest and beauty. Amongst the most striking of these are three species of evergreen pinnated-leaved Berberries, discovered in the north of China.

1. *Berberis Bealei.*

The first was met with in the autumn of 1848. I was then travelling in the district of Hwuychow, a place famed for its green teas, and which furnishes nearly all the finest kinds which are exported to England and America. The discovery is described in my journal as follows:—"Having taken a survey of the place [an old garden], we were on our way out, when an extraordinary plant growing in a secluded part of the garden met my eye. When I got near it I found that it was a very fine evergreen Berberis, belonging to the section of Mahonias, and having of course pinnated leaves. Each leaflet was as large as the leaf of our English holly, spiny, and of a fine dark, shining green colour. The shrub was about eight feet high, much branched, and far surpassed in beauty all the other known species of Mahonia." When dried leaves of this plant reached England it was supposed to be identical with Thunberg's *Ilex japonica*, of which there is a figure in his 'Icones Plantarum Japonicarum,' and which is no doubt a Berberis, and not an Ilex. After a careful examination, I have come to the conclusion that the Chinese plant is really distinct from Thunberg's; and I therefore propose to retain the name of *Berberis Bealei*, which I gave it in the 'Gardeners' Chronicle' for 1849. I have no doubt that it is quite as hardy as an English holly; and, if it proves so, it will be one of the noblest Evergreen bushes of which our gardens can boast.

2. *Berberis consanguinea.*

The second species (*Berberis consanguinea*) was found in the same district by one of my Chinese servants. It is easily distinguished from the former by the colour of its stems and leaves, which are of a light green. The leaflets are also more lanceolate in form, and have a tendency to vary; that is, some are lanceolate and some ovate or corolate. This is scarcely inferior in beauty to the last, and no doubt quite as hardy.

3. *Berberis trifurca.*

The third species (*Berberis trifurca*, Lindl.) was found in the province of Chekiang, and near the coast. I bought it in a cottage garden, but I was informed afterwards that it is cultivated extensively on account of the dye which it furnishes. It may be easily known from the other species by its dark green lanceolate leaflets, and, as Dr. Lindley has well observed, by the terminal one, which is almost always sessile. Its young stems are also covered with scales of a clear reddish purple colour, which give it a marked appearance. It is just possible that this species may be less hardy than the former, having been found about two degrees further to the south. This, however, remains to be proved, as it may have been brought south to the province of Chekiang for the purposes of cultivation.

There is a marked difference between these three Chinese species and the Himalayan *Berberis nepalensis* which it may be well to notice. The leaves of the Chinese kinds are of a stout and leathery texture, somewhat like the common holly, while those of the Himalayan species are thin and more flimsy. This difference in structure may be owing to the Himalayan plant courting situations of shelter and shade, and moreover accounts for its being less suited to bear the extreme cold to which the northern Chinese plants are liable.

The Chinese Berberries just noticed are all in the nursery of Messrs. Standish and Noble at Bagshot, but they are at present extremely rare and not for sale. They are propagated readily from cuttings; but although they grow vigorously enough, there is a difficulty in getting any number of young shoots for the purposes of propagation. As soon as they produce seeds they may be expected to become plentiful, and will no doubt be highly prized by all lovers of ornamental Evergreens.

XXI.—*Cultivation of the Paulownia imperialis.* By Charles Dorrien, Esq., F.H.S.

As this handsome tree so rarely flowers in England, though it grows vigorously, it may be interesting to some of the Society to learn the circumstances under which it has produced blossoms here, in perhaps rather a favourable situation on the south coast, and not more than 50 or 60 feet above the level of the sea. The plant I possess is now nearly 14 feet high, and the circumference of the stem, at a foot from the ground, is 14 inches. For several years it continued growing luxuriantly, making long shoots every summer, which only partially ripened their wood. It was planted in a large slate-box, and plunged in the ground, which was turfed over; the year before last it was removed, and in the operation it was found to have sent down several roots more than an inch thick, through the drainage holes into the soil beneath, which were necessarily cut off; and it was replanted in the same box in front of the house, in an aspect nearly due south, and sheltered from wind. In 1851 it did not grow so luxuriantly, and the summer having been unusually hot and dry, in fact, there had been no rain for more than two months, the leaves began to look yellow in September, when the shoots of the year began to show blossom-buds in the axils of the leaves, forming a terminal spike of six or eight to each branch. My anticipations of bloom were, however, partially disappointed, as in the course of the winter and spring the buds fell off one by one after sudden changes of weather, till at last only three were left. Those remaining opened in May, and much resembled a Gloxinia in form and colour, with the additional merit of being delightfully sweet scented, something like violets, remaining four or five days in perfection. The tree is again (Sept. 13) forming its flower buds, and therefore as the habit of flowering is induced, it may continue to do so.

Being a native of Japan, it must require considerable sun-heat in summer, and it is probably the dampness of our climate which prevents it from flowering, by causing it to produce long succulent shoots and leaves instead, particularly when planted in deep rich soil. Mine is in light loam, well drained. It seems not to suffer from frost; but the frequent and sudden changes of the weather in this part of England (where a frost of a few days is often succeeded by a temperature of 40°, with heavy rains, and afterwards a return of frost) cause the buds to drop off, as those of Camellias do under the same circumstances. I think it will be worth while to protect the flower buds by some light covering, such as a cornet of oiled paper, during winter.

It may be clearly inferred, that the system required to pro-

duce its flowers is to check its too rampant growth by root pruning and rather a poor dry soil; if this is pursued, planting it in a sunny place, not too much exposed to winds which injure its broad spreading foliage, I have no doubt it may be brought to flower tolerably freely; a little care would be well bestowed upon it, forming as it does such an ornamental large shrub or small tree, and for the sake of its fragrance it ought to be near the house, though I am aware many persons have been disappointed with it, as I was for some years. If planted in deep loose soil, or in a shady place, I believe it would never flower in this country.

Sennicots, near Chichester, 13*th Sept.*, 1852.

XXII.—*A new kind of Garden Edging.* By Robert Hogg.

When the Great Exhibition building was being erected, a paragraph appeared in a leading article in the *Gardener's Chronicle*, suggesting that the horticulturists of this country should on that occasion direct their attention to improvements in the implements and appliances of their profession. Among the subjects mentioned was "another material that would prove highly useful, would be a cheap earthenware edging to flower beds and walks; what we now have is too dear and too ill-made."

Feeling at that time the want of a durable edging for my own walks, I set about devising something in the material of "cheap earthenware," and succeeded to my own satisfaction in producing an edging which answers every purpose, both for cheapness, durability, ornament, and easy application.

My first intention was merely to satisfy my own wants; but many friends who saw my edging, and whose opinions in such matters are worthy of consideration, advised me to have it introduced for the general good.

With this view I have caused some of the tiles to be sent to the Garden of the Horticultural Society, for the opinion of the Society as to their applicability and usefulness.

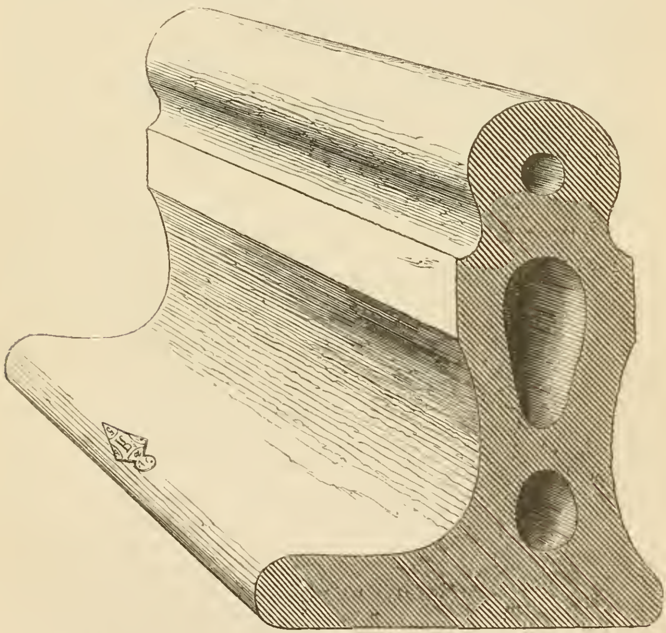
Their great recommendations are durability and ornament. They are composed of the same clay and are manufactured at the same works as the patent hollow bricks, and from what I have seen of them, they appear to become harder on exposure to the weather. Cheapness is another great qualification. They can be supplied in any quantity at 10*s*. 6*d*. per 100, or about 1¼*d*. each, each tile being one foot in length.

I would also call the attention of the Society to the mode by which they are secured in their position, although they allow

the borders to be cultivated close to them, and any extent of the soil disturbed or removed. The shoe which passes under the walk being covered with four inches of gravel, when that becomes "bound" the tiles are literally immoveable, and no wheelbarrow or roller can displace them. They also afford ample drainage for the walks, and under no pretence whatever do they ever harbour slugs. I have had experience of them for nearly twelve months, and I have found them answer all the purposes an edging is intended to supply, and that too at more than one-half less than dwarf box, and nine-tenths less than many other edgings.

I call them "Hogg's Edging Tiles for Garden Walks, &c."

13, *Gelston Road, Brompton.*



Note by the Vice-Secretary.—This kind of edging appears to possess much merit. It is hard, good-looking, a good colour, cheap, and enables the walks to be relieved easily of water. The accompanying figure represents one of the main tiles seen in perspective. It is $4\frac{7}{8}$ inches broad, $6\frac{3}{8}$ inches deep, and $12\frac{1}{2}$ inches long. In forming curves very short lengths of the same kind are employed.

XXIII.—*On the Effects of the Peach Stock on Trees worked upon it.* By Robert Thompson.

It was mentioned that the trees of the Shanghae Peach were worked on the Peach stock. As the buds take readily on this, the proceeding was advisable in the first instance in order to secure the sort. But it must be removed to the Almond or Plum stocks; for in this climate no Peach will thrive long budded on the Peach stock; the ground, it is presumed, is too cold for it. At all events, the leaves after several years acquire partial tinges of yellow: and this goes on every year increasing, whilst the leaves are annually produced narrower and narrower, till at last the tree becomes useless. Peach trees received by the Society from America were generally on the Peach stock, and they invariably became affected in the same way. George the Fourth Peach was one of the best of them. In a series of warm seasons it extended 35 feet along the wall; but being on the Peach stock its foliage became so narrow and yellow that it was found necessary to remove the tree. The same variety has now a healthy green foliage on the Plum stock.

This disease is doubtless the same as that so prevalent in America, where it is termed the *Yellows*. It is described by the late Mr. Downing, who perished, so much regretted, in consequence of the burning of the *Henry Clay* steamer; but his writings cannot fail still to produce a beneficial influence on American horticulture. In his *Fruits and Fruit-trees of America*, it is stated "that this most serious malady (the *Yellows*) seems to belong exclusively to this country, and to attack only the Peach tree. Although it has been the greatest enemy of the Peach planter for the last thirty (now thirty-seven) years—rendering the life of the tree uncertain, and frequently spreading over and destroying the orchards of whole districts; still, little is known of its nature, and nothing with certainty of its cause. Many slight observers have confounded it with the effects of the Peach-borer, but all persons who have carefully examined it know that the two are totally distinct. Trees may frequently be attacked by both the yellows and the borer, but hundreds die of the yellows when the most minute inspection of the roots and branches can discover no insect or visible cause." Now, Peach trees in America are either grown directly from the stone, or they are budded on Peach-stocks, very rarely on the Plum or Almond. In consequence of the buds taking so readily on the Peach, and growing to form orchard trees with such facility, it is preferred. According to the above-mentioned author, a Peach-stone "planted in the autumn will vegetate in the ensuing spring, grow three or four feet high, and may be budded in August or September.

Two years from this time, if left undisturbed, it will usually produce a small crop of fruit, and the next season bear abundantly, unless the growth is over-luxuriant." He also justly observes that "healthy Peach-stocks afford the most natural foundation for the growth of standard orchard trees." There can be no question as to that; but when on this stock whole orchards, some containing from 10,000 to 20,000 trees, become diseased in America, and when in England all on this stock, and on no other, are similarly affected under ordinary circumstances, we must conclude that the soil in both countries is uncongenial to the Peach roots. They are soft, spongy, yellow, more like a pale carrot than the roots of trees we usually see. Most probably the soil is too cold for them.

This probability is strengthened by the following instance. It was stated that all trees on the Peach-stock, under ordinary circumstances, were sooner or later affected. One of the Shanghae trees in the Society's Garden has foliage not tinged with yellow as that of the others are, although it is like them worked on the Peach, and is of the same age, planted at the same time in similar soil, and sharing with the others the same aspect. But its luxuriant foliage exhibits a healthy dark green colour. Nearly opposite to where it is planted there is the fireplace of a room adjoining the fruit-room; the lower part of the wall is there heated through to the south side, so that there the latter often exhibits a dry surface, when elsewhere it is wet; and the ground adjoining has been seen thawed when all not near this heated portion of wall was frozen; it is, therefore, evident that the roots of this particular tree must have been in a warmer medium than those of its fellows; and to this different circumstance, all others being the same, the difference as regards being free from disease may be fairly attributed.

These remarks may be the means of preventing the planting of Peach trees worked on the Peach-stock, and consequently the loss of the trees when they ought to be at their best. Excepting in parts of the world where the soil is never too cold, the Peach-stock ought not to be used. It is not the loss of only one plantation that has to be considered, for in such countries, as some parts of America, the trees rush up with little pains being taken, and they quickly bear sufficiently to repay that little; but presently disease makes its appearance, and the whole has to be cut down. The ground having been once cropped with stone-fruit, will not well bear such again without great expense in tending, compared with which that of procuring suitable stocks in the first instance would be inconsiderable.

XXIV.—*Remarks on the Cultivation of the Potato.* By James Hutchison.

(Communicated September 14, 1852.)

Since the commencement of the disease in 1846 I have grown the potato in various soils and situations in three different counties, viz. Brecknock, Hereford, and Sussex. That the potato should have become diseased is not wonderful when the general mode of cultivation in former times is considered. When taken up in the autumn they were generally put into large pits, where they underwent a process of fermentation, which to a certain extent injured the tubers. The usual practice with farmers was to keep their potatoes in such pits till about the beginning of May. By this time they had made shoots about six inches long. Those shoots were pulled off and the potatoes planted. The tuber was thus injured by fermentation, exhausted by growth in the pit, and not planted until a late period of the season. It is true that means were used to accelerate its growth by the force of stimulating manures; but, if we may judge from the experience of the last few years, such manures have only hastened the progress of its decay.

The method I have adopted is directly the contrary. I keep my potatoes cool and dry in winter. I plant early, so as to give the plant all the advantages which a cold and variable climate can afford. With regard to manure, I have taken a hint from the method which has been so successfully pursued with regard to other exotics which have been acclimatized. I prefer a moderately poor soil to one that has been enriched by the addition of strong manures.

There is another point worthy of consideration, although farmers seem slow in adopting it. Everything should be done that can by means of draining and deep working to raise the temperature of the land intended for the growth of potatoes. To the intelligent reader this will appear self-evident. But I have met with persons who were prejudiced against both draining and deep working. The opinion which such persons maintain is, that the former won't pay the expense, and the latter they have found to do more harm than good. It must be borne in mind that those operations should be performed with judgment. One man will drain a field at a great expense, and not do it properly after all; another will do it for half the cost of the former, and finish the work in a very efficient manner. With regard to trenching, it is not necessary to bring a foot or two of exhausted soil or stiff clay to the surface all at once. Let the soil be trenched two spades deep, if not trenched before, and throw the first spading

to the far side of the trench, and the second or under spading to the near side, and in this way top and bottom will lie side by side.

For the successful cultivation of the potato I am convinced that more depends on the condition of the soil than on the application of manure. It is not until the land is drained and pulverised to a certain depth that it has the ability of developing its powers. Moreover it is not until it is placed in this condition that free ingress is permitted to the carbonaceous and ammoniacal gases of the atmosphere. No sooner is the stagnant water drained off, and the soil opened up, than fertilizing gases flow in. This is one of the many ways by which Providence rewards the industry of man.

The cultivation of the potato is very simple. I plant in February or March, according to the state of the weather, in shallow drills, running from north to south, drawing the earth well over them. As the ground becomes solidified by wet weather after planting, I take the first opportunity of dry weather and frosty mornings to fork the ground over between the drills. By this process the soil will become in fine condition for earthing up the plants, which should be done in good time.

Some allow the ground to become covered with weeds, which exclude the sun's influence; and in the operation of hoeing many of the roots of the potatoes are cut, by which their growth is checked—a circumstance which always increases their liability to disease. It is scarcely necessary to say that the potato should be taken up and stored as soon as it is ripe, more especially if there be any appearance of wet weather. If diseased it should be stored in dry earth, sand, or similar material.

I do not say that the practice I have pointed out is a complete safeguard against all disease; but whoever follows it may look forward with a great degree of confidence both to "seed time" and "harvest," and he need not be troubled with those imaginary terrors which haunt men who trust to quack preparations for the cure of animal or vegetable debility.

XXV.—*Miscellaneous Memoranda.* By Robert Thompson.

In the Great Exhibition in 1851 was to be seen the following:—

"A Circular Earthenware Enclosure and Support, for the Fruit and Foliage of the Strawberry Plant, whereby the blossoms and fruit are protected from the blemishes produced by the ravages of the slug, also free from grit from the effects of rain. The material of which the pan is manufactured, together

with its exterior surface, retains a warm and moist atmosphere in the neighbourhood of the plant during the coldest night likely to occur in the season of its fruiting. Thus the flavour of the finest species is improved, and the greatest dimensions of the fruit obtained. The manner of using this pan is to allow the plant to grow freely till the first blossom is set for fruit, then gather the stems and foliage together within the compass of the cylindrical part of the Strawberry pan, then arrange the blossoms to be supported by the sloping part. This pan has a fine ornamental appearance, with the advantage of ripening its fruit a week earlier than any other mode of protection. Invented, and provisionally registered, April 28, 1851, by Thomas Smith, 1, Hanor Cottages, Hornsey-road, Islington."

In the Garden this was tried as directed. It does not appear from the trial that it possesses the advantages supposed. The leaves have to be gathered together and taken through the hollow stem of the pan. They are there comparatively dark and too much confined. The fruit was not so good as in the adjoining plants that were freely exposed to light and rain.

Some fruit of the Acton Scot Peach was thoroughly ripened, August 31, under sashes placed over a glazed trellis, the space under the trellis having been filled up nearly close to it, and paved with tiles. The fruit attained fully the average size of the variety, which is not naturally a large sort. It was 7⅞ inches in circumference; tolerably well coloured, and thoroughly ripened, being equally soft on all sides. The flavour was not however so rich as in those grown against an open wall; and the period of ripening was a fortnight later than that of the same sort against a wall. But the almost too vigorous growth of the tree under glass would make some difference in this respect; for with a great flow of sap the fruit does not ripen so early.

In former seasons the fruit on the glazed trellis did not ripen thoroughly: its underside, in two seasons, remained hard whilst the side next the sun was soft. That such was not the case in the present season must be attributed to the solar heat being partly reflected by the tiles, partly absorbed and given out to the part of the fruit next to them. It can only be accounted for in this way, for excepting the introduction of the tiles, all other circumstances were the same as in former years.

Since the above was written, additional experience has been gained respecting the effects of glazed trellises in ripening other sorts of Peaches, naturally later than the Acton Scot, such as the Royal George, Noblesse, and Chancellor. With regard to these

it will be seen that this mode of growing has given more satisfactory results. The following note was received from Mr. Samuel Woolley, Gardener to Henry Bellenden Ker, Esq. :—

"*Cheshunt*, *Sept.* 14, 1852.

"Mr. Ker being from home, I have forwarded you a sample of Peaches grown on the protected trellis. Those sent are a fair sample. We have had a very good crop. There are four trees, on which there were above 40 dozen, this being the fourth season since planting, and the fruit is better flavoured than those grown on the wall. The only protection the trees had was a little hay thrown over the glass during the sharp frosts in April."

The Peaches were of average size, well coloured, and of very good flavour. They appear to be the Royal George and Noblesse. The former averaged $8\frac{1}{4}$ inches in circumference, and the Noblesse $8\frac{1}{2}$ inches. The same sorts had been ripe a week previous on the open wall in the Society's Garden. On this some of the Noblesse measured 9 inches in circumference.

In this garden, one of the trees planted under the protected frame, along with the Acton Scot, was the variety called the Chancellor. It bore some fruit which ripened on the 17th September of the present year. The fruits were not from blossoms situated next the glass, on the front of the branches, for those so situated were killed by the frost in spring; they were from blossoms near the under sides of the branches, so that when full-sized the Peaches were close to the tile paving. They were compared with the same sort grown against a south wall. The fruit in both situations was about the same size, between $9\frac{1}{4}$ and 10 inches in circumference. As regards the time of ripening, those on the trellis were about four or five days earlier, but in point of flavour those ripened against the wall had rather the advantage.

From what has been stated, it is evident that Peaches can be very well grown in protecting frames, especially with a tile paving under the trellis for reflecting both heat and light, to a considerable extent; and that early sorts are retarded, but late kinds are slightly forwarded, comparatively with those matured against walls.

The facts which I had to state on a former occasion with reference to the Protecting Frame in the Society's Garden, were at variance with the anticipations of the gentlemen who proposed the plan, and also with the results they obtained. Mr. Rivers justly observed that this might be owing to the frame being in a situation more exposed to a current of air than those at Cheshunt. The constant ventilation of the frame was greatly reduced, that

is to say, a three inch opening was left only along the back, and perforated zinc in front ; and this season a tile paving was introduced under the trellis, as above stated. These modifications have reconciled the discrepancy.

It is necessary to remark, that in case of frosty nights when the trees are in blossom, the glass of these frames must be covered, for it has been proved in course of the experiment, that the blossoms are more liable to be cut off under the glass than they are against a wall. When frost is apprehended, the opening at the back of the frame could be easily closed ; and straw screens could be made for rolling over the glass at little expense.

With regard to economy, the first cost of the protecting frame and that of a wall are nearly equal for the same extent of surface. The protecting frame costs about 8*d.* per square foot, or 9*l.* 1*s.* 6*d.* per rod. A wall of the standard thickness, 14 inches, may be built for 10*l.* per rod; and a 9-inch brick wall for nearly one-third less, or, say for 7*l.* per rod, allowing for piers; and if we allow another 1*l.* per rod for foundations, still this substantial wall is upwards of 1*l.* per rod cheaper than an equal surface of glazed frame. The latter occupies much ground—it requires a breadth of at least 8 feet; the wall stands on 14 inches.

On the other hand, since it has been proved that Peaches can be grown in these glazed frames with ordinary care, they may be recommended where walls cannot be conveniently built. In parts of the country, also, where the Peach does not ripen well on the open wall, the protecting frame may be employed with decided advantage, provided additional attention can be bestowed in covering up in cold nights, and in giving more or less air according to circumstances.

XXVI.—*The Gardens and Orange-grounds of St. Michael's in the Azores—its Climate and Peculiarities.* By P. Wallace, Chiswick House.

(Communicated Sept. 16, 1852.)

The position of the group of islands termed Azores, or Western Islands, lying nearly half way between England and America, and near the middle of the North Atlantic Ocean, is no doubt well known to most people. St. Michael's forms one of the principal features of those fertile little specks of the ocean. It may be thought that such an atom of the earth could contain none or few objects of sufficient worth to interest cultivators in

England; and, indeed, gardening in the Azores, as in its mother country, Portugal, regardless of its fine climate for such occupations, has been wofully neglected, but latterly the spirit of improvement has commenced among the wealthy inhabitants of the Western Islands, and shortly St. Michael's will possess gardens which can only be rivalled by those at home.

Previous to describing the gardens of St. Michael's, it may be well to state that this island is evidently of comparatively recent sub-marine volcanic formation—symptoms of this are manifested at almost every step by the condition of its surface, which exhibits strong marks of having been formed by the violent agency of fire, by which means, in fact, it is supposed the whole of the Azores have been at different unknown periods forced up from the sea. St. Mary's Island may perhaps be an exception, yet from its strong resemblance in form and general appearance to the other islands, there can be little doubt that it has been forced above the level of the sea by volcanic action—it nowhere, however, bears traces of the effects of fire; and what is equally singular, St. Mary's is the only island of the Azores that produces stiff clay. The effects of these volcanic movements have given rise to appearances on the face of the country of a most picturesque and peculiar nature, which possibly are nowhere better exemplified than in the interesting characteristics of St. Michael's. In the eastern end of the island is a deep, extensive valley, surrounded by high mountains, many of them from three to four thousand feet above the level of the sea: this valley is named by the inhabitants Valle das Furnas.* There dame Nature at the present time still keeps her kettles boiling. The hot springs of the valley are numerous; the most remarkable is called the "Grand Caldeira," situated in the eastern part, by the side of a rivulet on a small eminence, on which is a basin twenty feet in diameter, where the water boils with prodigious fury, rising at times to the height of three or five feet, and so hot that the inhabitants usually boil their Indian corn in it for food. An egg is boiled hard in the springs in about the same time as it would occupy over a hot fire. A few yards distant from the Grand Caldeira is a cave in the side of the bank, in which the water boils in a furious manner, throwing out thick, muddy water, and often mud alone, to a distance of five or six feet from its mouth, accompanied by a hideous roaring noise. On throwing a stone into the aperture it redoubles its roaring, as if angry at the insult. In the middle of the rivulet are several places where the water boils up with so intense a heat, that a person cannot dip his finger into it without being scalded. On its banks are several

* Valley of Furnaces.

openings, out of which the steam rises to a considerable height, and so hot that it cannot be approached. In this truly wonderful valley are found, within a few yards of each other, hot sulphur-water and cold iron-water running side by side. About twenty yards distant from the Bocca d'Inferno, the name given by the inhabitants to the cave I have just described, gushes from a rock a strong stream of delicious effervescent soda-water, surpassing any I ever drank in England, and requiring no iceing to make it cool. Standing at this part of the valley spectators would be led to suppose that the bellows of a mighty forge were blowing near them, while sulphureous streams issue out so numerously that the neighbouring bushes are covered with pure brimstone, condensed from the steam.

The climate of St. Michael's is remarkably regular, the thermometer during the summer months ranging from 76° to 80° and 84° Fahrenheit. A few days in the summer of 1851 it stood at 94° in the shade, but the summer was unusually hot. At this period the night temperature ranges from 65° to 70° and 76°. During the winter months the day temperature is from 60° to 70°, often rising with strong sunshine as high as 76°. In the valleys, the night temperature at this season ranges from 50° to 60°. In January, I have sometimes remarked the thermometer at 40°, but these were rare occurrences. I have adopted this form of giving the temperature for the sake of brevity, making it summer from May to October, and winter from November to April.

The soil of the island is generally a friable loam, and in the plains of considerable depth, a great quantity being annually carried down by the heavy rains which fall in winter. Yet so fertile is this volcanic soil, that I have seen Indian corn growing where there were only six inches in depth of earth on the rock, and producing excellent crops. Many of the Orange-gardens are formed in places where there is little more than from fifteen to eighteen inches of soil above the shattered mass of rock and rubble, which the volcanoes have thrown together. In some localities a thin coating of black, peaty soil is found, but of so loamy a nature as scarcely to merit the name of peat.

The native plants of the Azores are not numerous; some of them, however, are objects of interest: Myrica faya serves the Azorians in a variety of forms, such as sheltering their Orange-gardens, and affording fuel, &c., whilst its bark possesses the property of tanning leather, and for this purpose it is much used by the natives. The sides of the mountains least exposed to the sea are covered with several species of Laurus, Myrsine retusa, Laurustinus, a native Juniper and Heath, both of great beauty, assuming much diversity of habit, according to soil and situation,

sometimes trailing down the sides of the mountains, at others growing up into large trees. Campanula Vidalii is the best I have seen of its genus; it forms a spreading bush, growing from two to three feet high, and producing masses of cream-coloured flowers. These, with the following Ferns, form the principal features of the native vegetation of St. Michael's:—Balantium culcita, Woodwardia radicans, several common Aspidiums, Osmunda regalis, Hymenophyllum Tunbridgense, and Lycopodium denticulatum abound.

My object in contributing these observations regarding the gardens and Orange-grounds of St. Michael's is, that I think they may prove of service to such of our wealthy aristocracy as may possess villas on the shores of the Mediterranean, pointing out, as I will do, what plants they might successfully introduce to ornament their lawns and pleasure-grounds, and those which best resist the baneful effects of the salt spray, when driven by strong winds from the sea to the shore.

The garden of Senhor José do Canto, the gentleman with whom I was engaged, contains about sixteen acres, a small portion of which is laid out in the shape of a kitchen garden and orchard, the rest in that of lawns and pleasure-ground. It was designed by Mr. Mocata, a London architect, and is situated on an incline facing, at about a mile distant from the sea. When I arrived it was partly laid out by Mr. Brown, an English gardener, sent here by the Messrs. Osborn, of the Fulham Nursery.

A large architectural conservatory was being erected for such plants as were too tender to withstand the sea breeze; and other operations were in progress for the completion of a good garden.

Senhor José do Canto at that time had collected nearly two thousand different species of trees, shrubs, and plants into his garden; and it was truly an admirable and beautiful sight to see the leafy natives of almost every clime growing side by side. The *Anona* and the *Apple*, the *Guava* and the *Green-gage*, the *Loquat* and the *Peach*, the *Poinsettia pulcherrima* and the old *English Oak*, all thrive together in this highly favoured little island. No attempt had been made to arrange the plants systematically, but as is generally the case in private gardens, they were planted in the belts or clumps in such situations as were thought suitable for them. The collection comprises some fine specimens of Paulownia imperialis, two of which are thirty feet high, with clear stems, ten feet above the ground (the stems measuring three feet in circumference at the base), and round spreading tops twenty feet in diameter. These two trees are about seven years old from the seed. The singular manner in which the Paulownia annually produces its flowers is worthy of notice. When the summer growth is made flower-spikes are

formed at the point of every shoot; and so perfect and full are the buds, that to all appearance they are about to open. They remain in this state until the leaves fall off in December, when they present a very singular aspect. The spikes are regular in form, and about six inches in length: the flowers are inclosed in a thick, light brown hairy calyx, which, in any climate where the summer is long enough to allow the Paulownia to ripen its growth, would prove sufficient protection to preserve the embryo bloom during winter. They continue in this condition until the beginning of March, when the flowers open a few at a time on the base of the spikes; and they keep in bloom for the space of a month previous to any leaves being developed. At the end of that period the trees become covered with light green foliage, which, added to the pale blue Gloxinia-like flowers, present a most lovely appearance. The leaves of the Paulownia, when fully developed, measure from ten to twelve inches in diameter. It also produces abundance of good seed.

The forest and ornamental trees that grew and withstood the salt breeze best, are Araucaria excelsa, Pinus pinaster, Pinea, palustris and Canariensis. Many other Pinuses were introduced, but they scarcely survived a year. Eucalyptuses all succeeded well. E. resinifera has been a long time introduced into the island; and there are some specimens from seventy to eighty feet high. Casuarina equisetifolia and stricta grow in perfection: of the former some plants are twenty feet high, surpassing in elegance of form any lawn tree I ever saw, with the exception of Araucaria excelsa, which I ought not longer to pass over without particularly describing. Our example of this Araucaria was planted in the most exposed part of the garden, without the shelter of a single tree between it and the ocean, yet after some of the severest storms, and when other plants which usually resisted the salt spray best were slightly injured, I could never discover any blemish on the Araucaria, whilst on the other hand, A. imbricata and Braziliana were damaged by the slightest amount of salt winds. One specimen of A. excelsa, in an orange-garden belonging to Mr. Ivens, a merchant of St. Michael's, and situated very near the sea, has attained the height of fifty feet. Another, in the garden of Mr. Dabigny, American consul at Fayal, is still higher, and has produced cones, but owing to the absence of male catkins the cones were barren.

I ought to state here, that the great taste for gardening which now exists in St. Michael's has originated with the English residents on the island. The late Dr. Nesbit was one of the first who began to introduce new plants into his garden at Nesbit's Pico, a small hill, so named from his country residence being built upon it. Here, at the present time, are some of the finest

specimens of Camellias, Arbutuses, Metrosideros, &c., in the island. In this garden is a plant of the Cajeputi tree, Melaleuca Leucodendron, above thirty feet high. The trunk is enclosed in a thick coating of thin layers of papyriferous bark. The Portuguese name it the paper-tree, on account of its shaggy bark being easily stripped off and divided into sheets, as it were, of fine paper.

The light and airy foliage of the Cajeputi, with its ragged coating, gives it a wild, interesting form, and at the same time a character quite its own.

I will now cursorily describe all the large trees that have been introduced, many of which have become already important features, not only on the face of the country, but in supplying wood for building, orange-boxes, and for other purposes. The greater part of the wood at present used for building is imported from America and Figaro. But within the last ten years plantations have sprung up on almost every uncultivated side of the mountains, where the soil is unfit for agricultural purposes. Formerly every proprietor in the island planted for himself, but latterly a more liberal feeling has prevailed, and now every piece of ground that will not produce corn or oranges is planted with timber trees. I have already stated that Pinus pinaster is one of the best trees for thoroughly resisting the effects of the salt spray; it is also one which has become universal throughout the island, and is the principal tree employed in the construction of orange-boxes. We have also Laurus indica, named Vinhatico by the Portuguese, and known in England as Madeira mahogany; there is likewise another Laurus, called Camphora by the natives, but it is quite a distinct species from L. camphora. When or how it was introduced I could never ascertain. This tree grows from sixty to seventy feet high, has intense deep green foliage, possesses a strong camphory scent, and produces abundance of spikes of white, sweet-scented flowers, which are succeeded by seeds resembling an acorn. If this tree would prove hardy in England, it would surpass any of our evergreen trees at present introduced.

In a neighbouring garden stood the parent-tree of all the Camphoras in the island; it is between sixty and seventy feet high, and sixteen feet in circumference at the base of the trunk, which is quite as knotted and gnarled as that of any of our old Oaks. These two Lauruses are widely disseminated throughout the island; the former is generally planted in plantations, the latter, at one time, was much employed as shelter for the orange-gardens, but being a gross feeder its use in that way has been greatly diminished.

In the garden of José do Canto are Oaks, Elms, Beech,

Chesnut, Birch, Limes (Tilia europæa), Alder, Walnut, Nettle-tree (Celtis occidentalis), Liquidambar, Ailanthus, Sumach, Fraxinus lentiscifolia (common Ash would not grow), Acers, Olives, Plane trees, the Honey Locust tree (growing to a large size, and producing abundance of long seed pods from fifteen to eighteen inches in length), and Salix babylonica and its variety crispa. Contrary to an idea I had always entertained, these willows grow finer and larger, planted in high and very dry situations, than I have ever seen them near watersides in England.

Taxodium distichum, another tree generally supposed to thrive best in damp places, when transplanted to a dry spot grew when other plants moved at the same time died. Some examples of this Taxodium, in the driest part of the garden, grew twenty feet high from seedling plants in five years.

The above, together with many other deciduous trees, succeeded well in the island. The greater part of them retain their leaves till near Christmas, and are again early in leaf in the spring. Populus alba might almost be called evergreen, retaining its foliage to the end of January, and by the end of February it is again covered with young leaves. P. angulata grows quicker than any other tree in the island, plants of it having obtained the height of forty feet in little more than five years, forming a stem proportionately thick. Among rarer deciduous trees which flourish here is Melia azedarach (the Bead tree), which is covered with masses of lilac-coloured flowers every spring—occupying the place our Persian Lilac does at home. It is much employed in the decoration of triumphal arches, and is strewn in the streets in which religious processions pass on saint-days. Erythrina caffra, Crista-galli, and Corallodendrum, all acquire a large size. E. caffra flowered last year for the first time in the Azores; its flowers closely resemble those of E. Corallodendrum, but E. caffra being of a much better habit, and producing its flowers when in full leaf, is superior to it in beauty. Acacia lophantha and julibrissin, owing to the large size they acquire, must be classed as trees. The Portuguese name the A. julibrissin "the Rainbow Tree," on account of its flowers possessing various hues.

In addition to the Coniferous plants already enumerated as being capable of withstanding the sea-breeze, are Juniperuses, Cupressus, Callitris, Thuyas, and Taxus. Most of the species belonging to these genera succeeded well in our garden, and if sometimes slightly injured by a continuation of high winds blowing from the sea, the rapidity with which young shoots and leaves were formed in spring soon obliterated all traces of the injury they had received. The Cedar of Lebanon and the Deodar suffer

very much and grow slowly, and the common Larch will scarcely exist in the island. Banksias succeed equally well here as in their native soil and climate; with the exception of B. palustris, they have been all introduced within the last four years, and some are already ten feet high, both blooming and seeding. Protea cynaroides grows well, while every other species introduced died. Some years ago José do Canto procured some Proteaceous seeds from the Cape, and was successful in rearing young plants of Leucadendron argenteum, which he planted in an orange-garden. One plant surpassed anything I ever saw: it is impossible to convey in writing any correct idea of the beauty of this silky and silvery-leaved native of the Cape.

The genus Ficus is spread over every garden of extent in the island. F. elastica and australis have been many years introduced; they grow to a large size. Ficus elastica retains the same straggling habit it has in our stoves. F. australis is a compact, noble tree. F. repens will become the Ivy of St. Michael's, growing over rockwork, and imparting a peculiar charm of light and shade—the old leaves being deep green and the young shoots a pale yellow, often tipped with a tinge of red.

Magnolias likewise appear to have found a congenial home in the island; some specimens of M. grandiflora are forty and fifty feet high, with spreading tops like an oak; at evening time the air is filled with the sweet scent of their flowers, and at noonday their branches form a favourite retreat from the heat of the sun. All the newly introduced Magnolias appear to thrive quite as well as M. grandiflora, which has been many years in the island.

Few Palm trees have yet been planted, but those which have been tried are thriving well. In the court-yards of many houses in the city of Ponta Delgado are Phœnix dactylifera, the Date. They are tall, noble-looking plants, producing abundance of bloom every season, yet, from some cause I could never satisfactorily find out, they bear no fruit.

I will now proceed to notice briefly a few of the flowering shrubs that are worthy of attention. Camellias have long been favourites with the natives. The inner courts of every convent and monastery contain some noble specimens; when newly introduced from nurseries in England they suffer a little from the winds, and grow slowly; but in a few years they become accustomed to their new home and flourish luxuriantly. I have measured some Camellias twenty feet high, forming lawn bushes like the Portugal Laurel in England. So great is the desire for Camellias, that several of the Portuguese gentlemen have purchased plants of all the named varieties in the English and French nurseries. Metrosideroses, Melaleucas, and Callistemons, all thrive well, and form objects of great beauty, flowering well

in the open air. Metrosideros speciosa surpasses in brightness of colour when in bloom any of the Rhododendrons. I saw one plant in the garden of an old Jesuit college, fifteen feet high, clothed with spreading branches to the ground, and covered with hundreds of bright scarlet feathery flowers; in fact, this plant and Poinsettia pulcherrima are the brightest coloured plants yet introduced. We have Telopea speciosissima in St. Michael's; but it has not yet equalled the abovenamed plants in beauty. Any one unaccustomed to see the gorgeous Poinsettia in perfection must be astonished at the effect it produces; its broad deep green foliage well sustaining the glare of bright scarlet furnished by its noble bracts. Brugmansia suaveolens is another plant of great beauty, producing its delicate white flowers four and five times a year. In many parts of the city of Ponta Delgado it is planted in the court yards, and overhangs the streets, filling the whole air in the evening with its delicious odour, a thing particularly desirable in a Portuguese town. Edwardsia microphylla and grandiflora, Oleanders, Myrtles, Eugenias, Cestrums, Aralia spinosa and triphylla, Hibiscuses, Azaleas, Gardenia florida and radicans, Franciscea latifolia, Burchellia capensis, Tristania neriifolia, Melastomas, Escallonias, Diosmas, Clethras, Clianthus puniceus, Clerodendrons, Corræas, Coronilla glauca, Cassias, Ardisia crenulata, Acacias, Abutilon striatum and Bedfordianum, Achanias, Brunsfelsia americana, Buddlea madagascariensis and Lindleyana, Indigoferas, Ingas, Juanulloa aurantiaca, Amorpha fruticosa, Anagyris fœtida, Anthyllis Barba-jovis, Amsonia salicifolia, Beaufortias, Benthamia fragifera, Buxus, Calycanthus, Callistachys, Chimonanthus, Caraganas, Cistuses, Cotoneasters, Cornus, Rhamnuses, Daubentonia, Deutzias, Durantas, Eranthemums, Justicias, Euonymuses, Fabiana, Eutaxia myrtifolia, Garrya elliptica, Genistas, Gnidias, Habrothamnus, Ligustrums, Leycesteria formosa, Berberries, Mimosas, Olea fragrans, Phlomis, Pimeleas, Piptanthus, Plumbago capensis, rosea, scandens, Larpentæ, Podolyrias, Polygalas, Pultenæa, Rhus cotinus, Ricinus communis, Jatrophas, Russelia juncea, Spiræas, Stachytarpheta, Templetonia, Cytisuses, Lantanas, Fuchsias, Roses, and Pelargoniums, all grow together in the open borders in rich luxuriance.

I must not omit to mention the following climbing and herbaceous plants in order to show how complete the Hortus Michaelensis is, and how much more so it, or any country possessing a similar climate, might be made. Ipomœas and Bignonias produce their showy flowers at every season of the year. B. venusta and I. rubro-cærulea bloom from November to March, growing over a stupendous rock-work side by side, and entwining their branches together. The deep rich orange-coloured flowers

of the Bignonia contrasted with masses of the delicate blue flowers of the Ipomœa was a sight not easy to be forgotten. Passion flowers, Bugainvillea, Clematises, Wistaria, Honeysuckles, Pergularia, Periploca, Jasmines, Lophospermum, Maurandyas, Dolichos, Phaseolus, all impart a charm when trimly trained against trellised walls or climbing up the sides of rockwork or dead branches placed in the ground for that purpose. Among herbaceous plants I would point out Hedychiums, Cannas, Alpinia nutans, Strelitzias, Heliconia, Cycas revoluta, Calla æthiopica, Bletia Tankervillia and hyacinthina, Begonias, Lilies, Amaryllis, Ixias, and Tritonias. Of these the Amaryllis belladonna is the Daffodil of St. Michael's; though not a native of the island, it is so thoroughly spread over it that every road-side is quite gay with it in spring.

Most of our herbaceous plants and annuals grow well. Dahlias flower from July till Christmas. The only native fruits of St. Michael's are a Vaccinium and a wild Alpine Strawberry. At the present time, besides Oranges, there are numerous Apples, Pears, Plums, Peaches, Nectarines, Apricots, Figs, Grapes, and Strawberries, which all do well under proper treatment; Gooseberries and Currants will not grow. Of exotic fruits there are three kinds of Guava (Psidium pyriferum, polycarpon, and Cattleyanum, the two last-named being the best); the Custard apple (Anona cherimolia), whose fruit is much liked by some; the Date Plum (Diospyros lotus, Kaki, and Virginicus: the former only has produced fruit, which, when first put into the mouth, has an agreeable taste, but it immediately becomes so astringent as to render it unfit to be eaten). Jambosa vulgaris (Rose Apple) produces a quantity of fruit not very desirable. The Pomegranate (Punica granatum) bears freely. All the different kinds of Granadilla bear abundance of fruit, which is much esteemed by the Portuguese. The Loquat (Eriobotrya japonica) is only second to the Orange, being noble in appearance, and frequently outrivalling the Orange tree in size, while its branches are laden with delicious rich golden fruit in April and May, when the Oranges are all sent to England. The Loquat is the only fruit of its season, and in the opinion of many it is superior to an Orange. Physalis edulis has become wild; it is found in every hedge-row, and is much used for preserving. Musa paradisiaca, sapientum, Cavendishii, abound in every part where there is a valley or shelter for them. The fruit is seldom left to ripen on the plants, it being found more convenient to cut them and hang them up in a room, where they are quickly matured by the aid of a little sweet oil put in a small hole cut in the end of the stalk.

We had the Lee-chee (Euphoria litchi), Longan, the Akee (Blighia sapida), Mammee tree (M. americana), the Wampee

(Cookia punctata), the Papaw (Carica papaya), the Malay Apple (Eugenia malaccensis), and several species of Anona growing in the conservatory without artificial heat, and only waiting for a proper place to be planted out in the open ground. Euphoria Longana was in flower when I left St. Michael's.

Melons, water and other kinds, are abundant during the summer and autumn months. The manner of cultivating them is as follows:—The ground is deeply trenched in April, after which holes are dug two feet deep and eight feet apart, the rows being the same distance; some rich manure is thrown into the holes and mixed with the soil. In this state they remain for a week or ten days, the manure and soil being stirred up two or three times during this interval. Two or three inches of soil are then spread over the mixture, and the seeds sown; a kind of basin is formed to protect the young plants from strong winds, which often blow in the end of April and beginning of May. As the plants grow they are thinned out, and the earth round them is drawn up and pressed firmly about the neck and roots of the plants that remain after thinning. This operation is performed two or three times, after which, with the exception of spreading out the shoots and cleaning, they are left to themselves. The varieties of Melon grown are "*legion;*" every one leaving the island on a visit returns with some new kind, which is generally sown along with the old sorts. In fact, so numerous are the plots of Melon gronnd that it would be impossible to prevent intermixture of the sorts taking place. I adopted the English method of stopping the shoots, and was more successful than my neighbours. The Water Melon must be allowed to run like a Vegetable Marrow, or no success will attend its cultivation. The heaviest Melon I produced was a kind of Beechwood, weighing 11 lbs. and of delicious flavour; the heaviest Water Melon 22 lbs. The latter variety is a universal favourite with the Portuguese, serving as food, at the same time quenching their thirst, and furnishing a wash for their faces. Cucumbers grow successfully treated in the same manner.

On arriving at St. Michael's, one of the first things I did was to erect a pine-pit, which I made on the same principle as the latest erected at Chatsworth. I adopted the planting-out system, having a lining in the front, and a stone path at the back, for convenience of watering, &c.

At this time I had not experienced an Azorean winter; and perceiving that material for making linings was likely to be scarce, as few horses were kept on the establishment, I saw it was quite necessary that some other precaution should be taken to insure bottom heat for my Pines. Neither boilers nor hot water pipes could be procured in the island; bricks were not manufactured, being prohibited by the Portuguese government. At last

I thought of the old can-flues. I ordered some clay-pipes to be made, eight inches in diameter, and constructed the hot chamber under the bed, more capacious than I would have done had I had hot water. I did this for fear of the flue overheating, and to prevent the roots from being burnt. The cans were laid down on a slight foundation carefully fitted into each other, and covered with a coating of mortar and red pumice stone. This I found quite effectual, and I would not hesitate to grow first rate Pine Apples on the same plan in England. I dislike the method of filling the space for the bottom with bricks, as is sometimes practised: it confines the heat; however little the obstruction, it is too much in the vicinity of the pipes.

In March, 1850, I received from the late Mr. Wilmot a batch of good succession Pines. The soil had all been shaken from their roots, and they had been packed without moss or straw in a packing case—a plan I would always adopt when sending Pines a long journey. They arrived in excellent condition, and were planted in a compost of peat, burnt refuse, and well decayed manure, all roughly mixed up together. My method of treatment was much the same as that pursued at Chatsworth; using, perhaps, more manure water, and keeping my Pines gently growing during winter. From May to October, 1851, I cut seventy Pines, averaging 5 pounds weight each; four smooth Cayennes, weighing respectively 12 lbs., 10 lbs., 9 lbs., and 8 lbs.; six Trinidads, averaging 8 lbs. each; six Moscow Queens, one 7 lbs., the others 6 lbs. each; six Ripley Queens, 5 lbs. and 6 lbs. each; six Antigua Queens, 6 lbs. each; and Jamaicas, Envilles, and Montserrats, proportionately heavy. The large Cayenne Pine was sent to Lisbon, to be presented to the Queen of Portugal. Pines will exist in a half-starved state in the open ground here, but they produce no fruit.

Vegetables can be had at every season. Asparagus is much superior to that at home; the whole stalk is tender and sweet. Seakale was rather difficult to force. Peas could be had from Christmas till June; French Beans every month in the year. Walcheren Cauliflower was the only one that did well; it is a real prize, producing fine heads winter and summer. All kinds of Cabbages succeeded well, and Salads of every description can be grown.

The foregoing remarks on the gardens of St. Michael's have principally been confined to that of my employer. José do Canto was the first to commence gardening on a large scale in the island. The situation for his garden was badly chosen, being exposed on every side to the sea: yet all the plants I have enumerated, with many others, flourish well; but many tender kinds would have done better in a more sheltered situation. With José do Canto began the

present great taste for gardening. Jealous of the improvements he was making, other proprietors began to follow his example. Senhor Antonio Borges, profiting by the bad effects he had witnessed in the garden of José do Canto, produced by sea breezes, selected a site for his garden in a valley at the west end of the island, very much resembling the valley I described in the beginning of this paper. Many plants succeeded well there that would not grow in our garden, particularly American plants. During my stay at St. Michael's I designed and partly laid out two large places for the Barão das Laranjeiras and Senhor José Jacome Correa. The Visconde da Praya employs an English cultivator, Mr. Webster, who is propagating and preparing plants for a garden the Visconde has proposed making many years. At present not much has been done. Some years ago Senhor Louriano made an English garden, containing grass, rock work, water, hill and dale, fountains, &c., on little more than half an acre of ground. Shortly after the Barão da Fontabella made a garden at Botelho, four miles from Ponta Delgado, consisting of a series of terraces, a large architectural basin, temples, statues, and fountains. In this establishment is a splendid Magnolia grandiflora, some arbours covered with Duranta Plumieri, and a plant of Tristania neriifolia thirty feet high; also some magnificent Camellias, Melaleucas, &c. This garden is small and very much crowded, yet very interesting. It is connected with Orange grounds that contain some beautiful avenues of Pittosporum undulatum.

The Orange gardens of St. Michael's are, however, what form the principal wealth of the island. But for them the country would be one large field of Indian corn. To preserve the Orange-trees from being broken by the high winds when laden with fruit, it is requisite to plant tall quick-growing trees round and across the quintas, the Portuguese name of the Orange grounds. These shelters, composed of Myrica Faya, Camphoras, Pittosporum undulata and Tobira, each possessing their own particular green, and scattered over the face of the country with an irregular hand, give a wild and varied charm to the landscape almost indescribable. It is every man's ambition to possess a quinta. They toil early and late, live on Indian corn-bread and water day after day, in order that they may purchase a quinta in which to spend their saint-days and Sundays. Quintas are the emporiums of pic-nics; the places of retreat of the citizens in summer. Most of them contain a snug cottage; and the shelters afford plenty of shady walks. These quintas are of as many different forms and sizes as they possess owners. Every proprietor is his own designer, and a great variety of taste is displayed. On one point, however, they all agree, which is that every quinta must have a high tower and flagstaff, from which flags and pennants wave on every occasion.

Orange-trees were first introduced to the Azores by the Portuguese; and as the fruit became an article of commerce in Portugal, their extension was encouraged in those islands, in all of which they grow. Fayal formerly exported nearly as many Oranges as St. Michael's. About ten or twelve years ago the Orange-trees of Fayal became infested by a species of Coccus to such an extent as to render the Oranges worthless. It was found impossible to destroy the pest, and the trees were all cut down. Terceira annually exports from twenty to thirty cargoes of Oranges; St. Mary's one or two. St. Michael's at present is the great mart for Oranges, but unfortunately there, too, the Coccus has made its appearance, and several quintas have been already destroyed. It is supposed by many that the Orange-trees in St. Michael's grow spontaneously, and produce their fruit without any care. This is a mistake. Before the Orange-trees can be planted, a high wall must be built, and Pittosporum undulatum planted around and across, to break the force of the winds. P. undulatum is now generally used, growing quicker and possessing a more handsome appearance than the other trees employed for this purpose. A hedge of P. undulatum will grow in five or six years from twenty to thirty feet high. When the walls are built and shelters planted, the ground is trenched, but an attempt is seldom made to level it, the walks following the natural undulations. This done, the Orange-trees are planted at a distance of from twenty-five to thirty feet apart, and the ground sown with Lupins, which are considered by the Portuguese to be a favourite food of Orange-trees. Seven years elapse from planting-time before the Orange-trees come into full bearing; during which space the garden is cropped with broad Beans, French Beans, Melons, and Water Melons. The quintas of the poorer proprietors are always cultivated; the wealthy discontinue this practice at the expiration of the above-named period.

The Orange-trees are annually pruned—thinning out their superfluous branches, so as to allow a free circulation of air, which is required for the proper maturing of the fruit. The trees bloom in March and April, and Oranges are gathered as early as November for the London markets. The Portuguese never eat them before the end of January, at which time they possess their full flavour.

Orange grounds vary in size from one to sixty acres, and they are rarely wholly occupied by Orange-trees; Limes, Citrons, Lemons, Guavas, and other fruit trees are scattered about in them. There are only two kinds of Oranges cultivated in the island, viz., the Portugal and the Mandarin; many varieties of the former exist, and they are greatly improved by the genial climate of St. Michael's. The Mandarin Orange has not been many years

in the island, nevertheless there are some trees of it fourteen feet high and nearly as much in diameter. This capital little Orange has lately been exported to England, where it realizes a higher price than the common St. Michael's. The largest Orange-tree I measured was thirty feet high, the stem being seven feet in circumference at the base. The produce of the trees is almost incredible; props are always used to prevent the weight of fruit from breaking down the branches. I was told by Senhor Jacintho Victor Vieyra, a gentleman on whose veracity I could depend, that an orange-tree in the quinta of the Barão das Laranjeiras produced twenty large boxes of oranges, each box containing upwards of a thousand fruit. On telling Senhor Vieyra of the large tree I had measured, he assured me that in the garden of the Barão (who was the father of Orange growers in the island) many larger trees had been cut down, having been destroyed by the coccus, which attacks old trees first.

In the Orange grounds of the wealthy a small portion is generally devoted to flower gardening and ornamental shrubs; sometimes surrounding their casinho, or in a remote part of the quinta, sheltered on every side from the winds. It is in these places fine specimens of exotic plants are to be found. In a quinta belonging to the Visconde da Praya, at Roche do Cão, are two plants, Dracæna draco and arborea; the former has a clear stem, twenty feet high, with a large spreading top; the stem was six feet in circumference, and nearly the same in thickness to the top—D. arborea was forty feet high. In another quinta belonging to the same nobleman, in the centre of a circular Camellia garden, was the best plant of Pandanus odoratissimus I have seen. Much of the fine effect that might be expected in a large Orange-garden is destroyed by the quantity of shelters that intersect the gardens, yet they possess delightful walks and avenues of Pittosporum, and are, on the whole, very enjoyable. Two hundred ship-loads of Oranges are annually exported from St. Michael's, being nearly two hundred thousand boxes.

P.S.—I observe that I have omitted to describe the Caiota, (Sechium edule, or Sicyos edulis.)

This interesting and valuable plant was introduced to St. Michael's from Madeira—I believe it to be the Sechium edule of Jamaica. It is perennial, and from October to February bears abundance of its delicious culinary fruit. It is esteemed by the Portuguese beyond their native Cabbage, and that speaks volumes in its favour.

The substance of the Caiota is much firmer before and when cooked than that of the Vegetable Marrow; its taste partakes of

the flavour of Asparagus and Cauliflower. In my opinion it is the most delicate vegetable I have ever eaten.

So much is it esteemed by the Portuguese, that they think the English cannot fail to like it, and are making attempts to export it for the London market, as it will keep in a fresh state a long time. I think it could be easily cultivated in England: growing as it does through the summer months, and producing its fruit at a cold season, it would merely require protecting from the frost. Yielding its fruit at a time when vegetables are usually scarce, it would be invaluable to gardeners, and a great addition to the dinner-table.

The Caiota attains the weight of two to three pounds, delights in a rich soil, and will grow trailing on the gronnd in the same manner as the Vegetable Marrow; but the approved way of cultivating it by the Portuguese is to plant it against, and allow it to run over, a high wall. It will bear pruning to any extent. The fruit of the Caiota has a rugged, roundish form, of a pale yellow colour, and somewhat resembles the fruit of the Shaddock; the pulp is pure white.

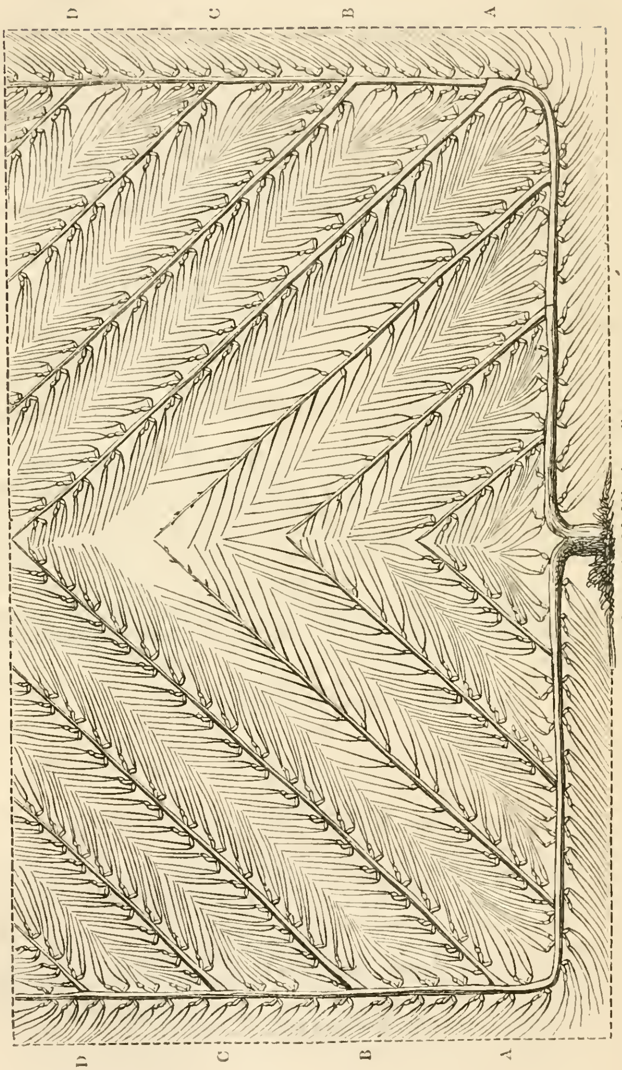
In the list of vegetables that succeed in the island, I ought to have mentioned Potatoes, Carrots, Parsnips, and Turnips. Potatoes became diseased at the same time as in England, and the disease still continues, more or less, in certain localities. Potatoes planted in December will produce in March; the same tubers being kept a short time, and again put in the ground, will produce another crop; and a third crop can be had almost within the year. I have had four crops of French Beans in the same way.

XXVII.—*Two New Forms in which Wall Trees may be trained.**

By none of the methods hitherto employed can trees trained on walls be established in less time than from 11 to 21 years, according to the kind of tree. Take, for example, a Peach-tree trained half horizontally against a wall 10 ft. high (fig. 1); this form is one of the simplest and most easily obtained, and 10 ft. are, upon the whole, the most convenient height for the wall. Let us further suppose that Peach-trees are planted along the wall at a distance of 7 yards from each other; each tree will then cover a surface of 25 square yards. Experience shows that this space is necessary in order that these trees, planted in a

* Translated from the French of M. Du Breuil.

Fig. 1.



Peach Tree, trained half horizontally.

soil of average fertility, may produce good fruit and preserve a proper state of health. If the secondary branches be placed at a distance of 2 feet from each other, six of them may be developed on each tree. If an interval of two years between the time of obtaining the first and second stages of secondary branches be allowed, it will take seven years to obtain the whole number of stages, and four years more must elapse before the upper secondary branches can attain their full length; that is, altogether, eleven years.

If instead of Peach-trees we take Pear-trees, and train them as above against a similar wall, planted as before in a soil of average fertility, and grafted on Quince stocks, the same space must be allowed between them as was allowed in the case of the Peach-trees; for Pear-trees ought to cover the same surface to be sufficiently productive. But as the secondary branches should be placed only one foot above each other, they cannot be all obtained in less than thirteen years; and if to that we add four years for the completion of the growth of the upper branches, we have seventeen years altogether.

Pretty nearly the same period of time is required by all the other forms of training, and it becomes longer still in the cases of Cherry, Plum, and Apricot trees trained against walls; for these trees have a greater number of secondary branches, the spaces between which ought not properly to exceed 8 inches, and only one stage can be obtained in a year. It takes, indeed, nearly twenty-four years to get these trees into the form mentioned.

It is true the principal branches of these different trees may be sometimes obtained much more quickly; for example, by making several stages grow in the same year either by winter pruning, or, which is better, by causing the development of buds by means of summer pruning. But these methods can only be adopted in special cases, and when the trees are more than usually vigorous; otherwise the growth of the lower secondary branches is almost always injured. What we have stated above is then true as a general rule.

But length of time is not the only ground of objection to these forms of training. If by any accident (and this often occurs in stone-fruit trees) one of the secondary, or even one of the primary, branches be lost after the tree is formed, whether it be fan-trained, *en candélabre*, or horizontally with two stems, it is a matter of exceeding difficulty, not to say impossibility, to refill the space thus left empty. The tree consequently, during the remainder of its existence, occupies profitably only a portion of the space originally allotted to it.

On the other hand the different methods at present in vogue,

and especially those of fan-training, *candélabre*, or horizontal, from double stems, demand no little attention and care in order that the vegetation of the different parts of the tree may be kept in equilibrium. This cannot by any means be done by every gardener, and occupies a very considerable quantity of time.

In short, as matters stand, a period of time varying from eleven to twenty-one years, according to the species, is required to make a tree completely cover the space which ought to be allotted to it. A consequence of this is, that about one half of the wall remains unoccupied for five, eight, or ten years, according to the kind of tree, without reckoning the spaces which are lost during the whole life of a tree by the death of one of its branches. The unprofitableness of one half of the wall for nearly eight years, in the case of Pear-trees, is to be regretted, notwithstanding that it bears a small proportion to the whole time during which these trees are profitable, and which, under good management, is about sixty years. But this loss becomes much more important in the case of stone-fruits, such as the Peach, which does not last above twenty years, or as the Apricot, Cherry, and Plum, which cannot be kept profitably more than thirty years.

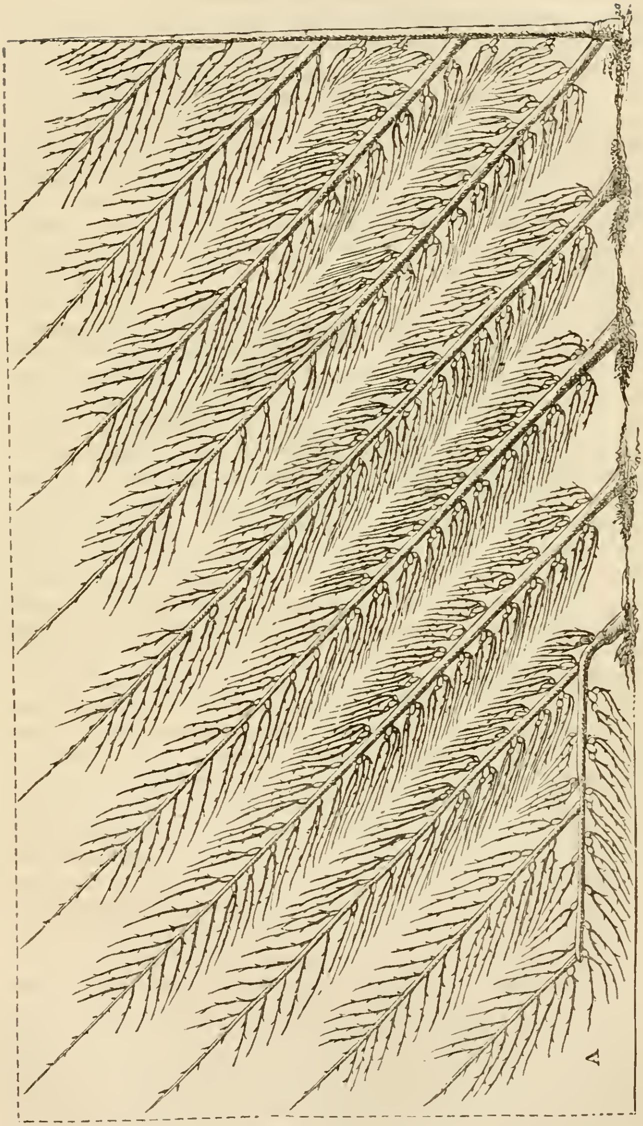
It was to avoid this loss of space and time that formerly the trees were (and even now too often are) planted much closer to each other than we have mentioned, so that each one covered much less space, and was more quickly developed. But this plan is still more disadvantageous than the other; for the sap, being confined in too small a space, makes the tree so vigorous that it will not fruit at all.

We have several times seen Pears on walls thus planted, and which, although some forty years old, had produced nothing but such an abundant supply of wood, that it had to be removed every year. At other times trees are planted close, with the intention that when they interfere with each other every other one shall be removed. But then one does not like to make this sacrifice when the time for it arrives; or, if it be made, the trees which remain can with difficulty cover the spaces left vacant, inasmuch as their roots, as they extend, enter ground already exhausted by the trees removed.

To overcome these inconveniences we were led to train fruit-trees in two forms, which can be established with less difficulty than any other, and which, allowing the trees to cover the wall regularly and quickly, do not interfere with their longevity or productiveness. One of these forms is the following:—

Simple oblique course (fig. 2). The annexed figure was originally published in 1846, in the first edition of the Author's *Cours d'Arboriculture*. We have no hesitation in again draw-

Fig. 2.



Simple Oblique Training.

ing attention to the arrangement there shown; for it is very important, and has been attended with complete success wherever it has been adopted. The Peach-trees (for this plan is only applicable to them) are planted obliquely at a distance of 34 inches from each other, and so that, the stems being inclined at an angle of 45°, the perpendicular distance between any two of them which are adjacent may be 2 feet. At the first pruning the stem is cut at about 20 inches from the graft, and during the following summer the shoots which make their appearance are so managed that an elongation is obtained only at the top, whilst fruit-branches are produced on the two sides. The next year the length of the new growth is left at from 2 feet 4 inches to 3 feet, according to the strength of the tree, and the fruit-branches are treated in the ordinary way. The stem of each tree is thus made to elongate continually, in the line of inclination, until the top of the wall is reached. The tree is then completely formed, and consists of one single stem inclined at an angle of 45°, and bearing nothing but fruit-branches.

Fear might be entertained lest the sap, being confined to a single stem, should cause the lateral buds to develope too vigorously to admit of the formation of flower-buds. But this action of the sap being proportional to the quantity of the roots, and these being confined by their proximity to each other, the vigour of the trees does not become excessive. The walls against which trees are thus trained should not be less than 10 feet in height, otherwise the trees will, notwithstanding their inclination, be too confined to fruit well.

In order that empty spaces may not be left on the wall, it is necessary, as appears from the figure, to begin the series of trees, to the right, with a half horizontal, and to end, to the left, with a tree bearing a horizontal principal branch A, which itself must bear secondary branches inclined at an angle of 45°. This principal branch is in fact nothing but the original stem of the tree gradually brought down, and upon which the secondary branches have been allowed to develope, beginning with those farthest from the stock.

Let us now see whether this arrangement does or not possess the advantages we ascribe to it. And first, inasmuch as the successive elongations of each stem when pruned are on the average 32 inches in length, it cannot take more than 6 years at most to cover a wall 10 feet in height, since the stems inclined at an angle of 45° are at the end of that time upwards of 16 feet long. Five years, then, at least are gained by the above method, which cannot be gained by any of the others, and most of the inconveniences attributed to them are at once avoided by this. If one of the trees should die, another may be put in its

place, and the empty space is soon refilled. Lastly, this form of training is very easily accomplished, and the regular inclination of the stems renders the means of equally distributing the action of the sap extremely simple.

As to the productiveness and longevity of trees thus trained we are perfectly satisfied, both by those which were planted by us 10 years ago in the Garden of Plants at Rouen, and by others since planted in the environs of Paris, and all of which are quite equal to those treated in the ordinary way, that in this respect the above plan is inferior to none.

But as we have said, the plan can only be followed in the case of Peach-trees. The following arrangement, which is quite new, appears to us to be applicable and with similar advantages to trees of other sorts.

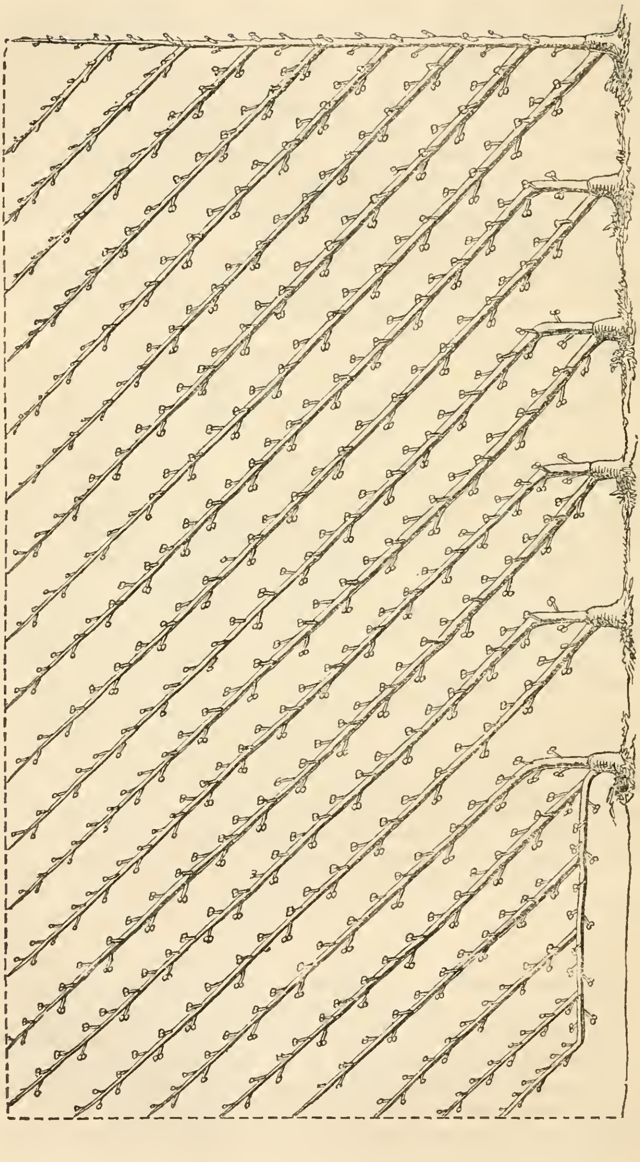
Double oblique Course (*fig.* 3).—The only difference between this and the arrangement already described is that in the latter the perpendicular distance between the stems was 2 feet, whilst in this it is only 1 foot. That is the space which ought to separate the branches of a Pear-tree, which has been taken as an example in the figure. This necessity, however, gives rise to another; the trees being planted at a distance of nearly 3 feet from each other, in order to afford their roots sufficient room, two branches have to be developed instead of one as before.

This sort of training is established as follows. The trees should be strong maiden plants; they should be planted vertically with proper care in the places marked. The first year nothing more is to be done than to remove portions of the stem in order to establish an equilibrium between it and the roots. The next year a single shoot at the top of each stem must be left to grow vigorously, all the others being converted into spurs by the proper means. In the spring of the following year, the young trees having taken good hold of the ground, and already grown, each stem is to be inclined from its base at an angle of 45°. During the succeeding summer one vigorous shoot is allowed to develope in a vertical direction immediately above the bend. In the 4th spring the branch produced by this bud is itself bent, half a yard above the ground, parallel to the first branch.

Care is to be taken during the next summer to maintain an equal vigour in the two branches of each tree, and to promote the vigorous growth of each terminal shoot by converting all the others into spurs. In pruning, about 32 inches of the leading shoots should be left, unless they are of unequal strength, in which case the strongest is cut shorter. The same operation is repeated every year until the trees reach the top of the wall.

If it were desired to apply this plan to Cherry, Plum, or Apri-

Fig. 3.



Double Oblique Course.

cot trees, the young trees should be planted at a distance of 2 feet instead of nearly 3 feet from each other, in order to have the branches 8 inches apart, which is sufficient in these cases. The advantages of this plan are the same as those which belong to that adopted in the case of Peach-trees. The two branches which each tree has may be obtained in 6 years at most, and thus time is gained to the extent of 11 years for Pears and 15 years for Cherries, Plums, and Apricots. The powers of production and of vitality do not appear to be lessened by adopting the double any more than by adopting the single course.

It is no small recommendation to be able to adopt, for trees against walls, a form which is obtained and kept up at a much less cost of time and care than is ordinarily incurred, and to fill up with ease any empty space to which accident may give rise; but if in addition we find that the same surface of wall is covered by the plans proposed in one half the time taken by those ordinarily followed, the advantages appear to us to preponderate greatly in favour of the former. It cannot be denied that the new forms are less agreeable to the eye than most of the others, but that will not be thought of much moment by those whose object it is to derive profit from their trees.—*Revue Horticole, Sept.* 1852.

XXVIII.—*New Esculent Vegetables and Fruits examined in* 1852 *in the Society's Garden.* By R. Thompson.

"*Hardy's Transmuted Shallot to Onion*," or *Hardy's Shallot Onion.*

Seeds of this were presented to the Society, March 20th, 1851, by Messrs. Hardy and Sons, Maldon, Essex, accompanied with the following note:—

"The transmuted shallots, or rather onions, raised by us from shallot seed, and planted last winter, did not produce potato onions, as was presumed they might, but numerous heads of seed varying from 10 to 20 from a single bulb. They certainly possess the qualities of both onions and shallots in flavour, size of the onions, and the fact of their being divisible like shallots. The blade is very narrow, partaking of both species. The seed is small."

The seeds were sown when received, March 20th; and the produce is a mixed race, varying in size, form, and colour. Some are regularly formed by concentric layers, like an onion, and not unlike a Reading onion. Sometimes the formation consists of two closely-conjoined, compressed, but separable bulbs;

and frequently clusters are produced very like shallots. The colour in some approaches that of the Silver-skin Onion, in others the Blood-red; but the generality are reddish-brown. They are strong-flavoured, and have the appearance of being good keepers.

From the want of uniformity in the size and form of the bulbs, the crop would not be profitable for the growers for market. By a judicious selection of bulbs for seed a useful sound-keeping variety may very probably be obtained.

Florentiner Pfluckerbse Pea.

Presented to the Society by Mr. Seitze, Royal Gardens, Munich.

This was stated to be a good variety of early pea. It proves the same as the Early Frame.

Paradise Pea.

Presented by Messrs. Stuart and Mein.

Sown May 17th; fit for use July 23rd. About 4 feet high; pods straight, flattish, containing 6-7 peas of good quality. An abundant bearer. Dry seeds yellowish-white. Allied to the Early Charlton.

Doré de Fitz-James Pea.

Presented by Bossin, Louesse & Co., Paris.

Sown May 17th; fit for use July 20th; about 4 feet high; pods straight; flattish, in shape and size like those of the Charlton, but the pods, and also the peas, are pale yellow. It is a curious degeneration, most probably from the Charlton; the plants are similar in growth to those of the Charlton. The quality of the peas is very good; but the want of greenness in the pods, even in a young state, would render the sort not marketable.

Sutton's Early Goliath Pea.

Received from Messrs. Sutton and Son.

Sown May 17th; fit July 18th; about 4 feet high. Pods tolerably large, containing about 7 good-sized white peas, of excellent quality. A very good early productive pea.

Sutton's Superb Marrowfat.

Received from Messrs. Sutton and Sons.

Appears to be the same as the Woodford Green Marrow.

Early Prince of Wales Pea.

Presented by Messrs. Whalley of Liverpool.

Sown February 16th; fit June 25th. Appears to be a well-selected Early Frame.

Royal Alfred Pea.

Presented by Messrs. Weeks and Co.

Sown February 16th; fit July 14th; from 3 to 4 feet high, of strong growth; pods large, nearly straight, containing 6-7 peas of good quality. A sort of Marrow, but not so sugary as Knight's.

Trial of Early Peas.—The following are the results of sowings of different kinds of Early Peas, made with the view of ascertaining their comparative merits in point of earliness:—

1. *Early Frame* . .	sown	November	15;	fit June	4.
2. *Early Kent* . . .	do.	do.	15;	do.	4.
3. *Early Emperor* . .	do.	do.	15;	do.	4.
4. *Sangster's No.* 1. . .	do.	do.	15;	do.	4.
5. *Early Charlton* . .	do.	do.	15;	do.	24.
6. *Early Long-podded Bishop's Dwarf* . . .	do.	do.	15;	do.	24.
7. *Early Surprise* . .	do.	do.	15;	do.	24.

The first four of the above may be considered identical. Sangster's No. 1 was admitted to have been sent out in mistake. Slight differences will take place in the Early Frame, and other sorts, in consequence of the mode of saving. Hence the Early Kent and Early Emperor; but they are certainly not decidedly different permanently. They were exactly alike in the above trial.

Haricot de Prague jaspé.

Obtained from M. Vilmorin, of Paris.

This is a tall running Kidney Bean, but the pods are rather thin-sided, and the seeds soon become prominent, therefore it is not to be recommended for use in a green state: the dry seeds, however, are said to be of excellent quality.

Haricot de Belgic.

Presented to the Society by Messrs. Bossin, Louesse and Co., Paris.

This has black seeds, but it is quite different from the *Haricot Noir de Belgic*, which is a dwarf sort, and this is tall; blossoms

white, pods large, 5 inches in length, and still tender. A tolerably good bearer, but not very early.

Where sticks can be afforded, this variety deserves cultivation, for its quality is very good.

Bush Haricot (*Haricot solitaire*).

Obtained from M. Vilmorin, of Paris. Seeds of this were distributed to the Fellows of the Society.

Grows about 15 inches high, throwing out a number of branches nearly close to the ground, thus forming a sort of bush. The shoots successively emitted bear in succession; whilst they also shade the ground, and tend to keep it moist in dry weather. The flowers are of a pale blush. The pods are abundant, 5 inches in length, crisp, transparent, excellent. They commence to form tolerably early, and they continue long fit for gathering in succession. The dry seeds are speckled red and white.

The rows should be 2 feet apart, and the plants half that distance from each other in the row.

This forms a valuable succession to the earlier sorts, especially during hot, dry weather.

Small white-seeded Haricot.

Presented by John Tinne, Esq.

This appears to be a variety of the *Haricot riz*. The seeds are small, white, roundish-oval, like those of the Haricot riz, but larger; and the plant is earlier, more productive, and hardier, consequently better adapted for this climate. Its growth is between dwarf and tall. The blossoms are white; pods long, rather narrow, pale green, tender, but not so fleshy nor so good as various others for use in a green state. It may, however, be well substituted for the Haricot riz in cases where that variety is preferred on account of its small white seeds.

Newington Wonder French Bean.

Seeds of this were received from Messrs. Lee, and from Mr. Rendle.

Both proved to be correctly the same variety; and it is an excellent one. Very dwarf, about a foot high, early, and productive. The pods are moderately long, not very broad, but having thick fleshy sides, within which the seeds form but slowly, and the pods remain long crisp; their colour is dark green. It may be planted in rows 18 inches apart.

Black Belgian Kidney Bean.

Received from M. Vilmorin, of Paris.

Although this variety has been previously noticed in the Society's Journal, yet the present mention of it will doubtless be excused, for it may be usefully stated that it is the best for both early and late sowing. It is dwarf, and may be sown in pots before the open ground has acquired sufficient warmth, and if planted out when this is the case it soon comes into bearing. Again, late in summer, when taller sorts would not even blossom if then sown, the sort in question will produce a good crop, that will keep in gathering condition till cut off by frost. This, and the Newington Wonder, are considered the best varieties of dwarf Kidney Beans.

Türkische Bohne (*Schlachtschwerdt-Stangenbohne*).

Presented to the Society by John Tinne, Esq., together with the original label, bearing the above name, under which he had obtained the variety from the Continent.

It was also stated on the label that ("*diese Sorte liefert* 12 *bis* 14 *Zoll lange und über* 1 *Zoll breite Schoten*") this sort bears pods from 12 to 14 inches in length, and upwards of an inch in breadth. They did not attain these dimensions here, the season being dry, and the ground cold in the early part of summer; but some were ten inches long, and nearly an inch broad, and doubtless they would grow to the full size mentioned in a moist warm season. It appears to be the same as the *Haricot Sabre d'Allemagne* of Noisette's *Manuel du Jardinier*, and the *Sabre* of the *Bon Jardinier*.

It grows tall. The pods are large, curved, tender even when the seeds are half grown, but the latter then render it objectionable. It does not remain so long in gathering fit for use in a green state as the Bush Haricot (*Haricot solitaire*) and several others, nor does it bear so abundantly. It has, however, good qualifications, which are thus described in the *Bon Jardinier* :— "This variety is, perhaps, the best of all; it bears tolerably well; its pods are of an extraordinary length and breadth; in a young state they make excellent *haricots verts;* when nearly full-sized they are still tender and fleshy, and may be used in this state, either fresh, being broken in small pieces, or, in winter, after being cut into narrow strips and preserved with salt." The dry seeds are tolerably large, flat, kidney-shaped, and white; and in point of quality the French rank them amongst the best, whether used new or dried. It therefore appears that this variety possesses good properties, which those

who can may turn to account. But it is necessary to observe that it requires good tall sticks, and these are too expensive, excepting for those who have their own plantations to cut from.

Duchesse de Trévise Strawberry.

Presented to the Society by M. Jamin, Bourg-la-Reine, near Paris, Sept. 6, 1851.

Fruit middle-sized, ovate, deep red; seeds small, rather deeply embedded; flesh pale red, juicy, with a brisk rich flavour. Leaves large, roundish, widely and rather obtusely serrated. Leaf-stalks moderately tall, very hairy, the hairs on these spreading horizontally, but those on the scapes and runners are adpressed.

Appears to be a good bearer, ripening quite as early as Keens' Seedling. It will require to be planted as widely apart as the sort just mentioned. As far as can be judged of it in the present season it seems deserving of cultivation, or, at all events, certainly of further trial.

Salter's Versaillaise Strawberry.

Presented to the Society by Mr. John Salter, Nurseryman, Hammersmith, Oct. 24, 1852.

Fruit large ovate, sometimes flattened or cockscomb-shaped; dark red; seeds rather deeply embedded; flesh pale, juicy and rich. Leaves middle-sized, roundish-oval, widely serrated. Leaf-stalks, scapes and runners hairy, the hairs spreading almost horizontally. A good bearer, ripening about the same time as Keens' Seedling, to which it will doubtless be preferred by those who like a brisker flavour than is possessed by Keens' Seedling. On the whole, it is worthy of recommendation, being large and a good bearer; many of the new sorts have these properties only, but this has also good flavour.

Beadnell's Seedling Pear.

This was raised by John Beadnell, Esq., West Green Road, Tottenham, and cuttings of it were presented by him to the Society.

The fruit is nearly middle-sized, turbinate, stalk short; eye a little open; skin pale yellowish-green on the shaded side, red next the sun, much speckled with whitish-grey dots. Flesh melting, exceedingly juicy, and rich. It is not buttery, but so melting, when used in its full perfection, that one can scarcely say whether he is not rather drinking than eating. Its period of ripening varies between the middle of September and that of

October. It does not keep long after being ripe. The tree is vigorous, and bears very abundantly. Shoots long, bright chestnut coloured where well exposed, much spotted with whitish dots. Leaves moderately large, cordate on the young shoots, somewhat concave and acuminate, serrated; those on the spurs are elliptic. Stipules linear, rather more than half the length of the petioles.

This variety cannot fail to be very acceptable on account of its rich, abundant, and highly refreshing juice.

Shanghae Peach.

This variety was sent to the Society by Mr. Fortune, who found it growing to a very large size in the North of China.

Along with a plant of it in a pot, he sent some of the peach stones. These were sown and came up abundantly; but they had a very unpromising appearance for fruit, their foliage being narrow, and altogether unlike that of a cultivated sort. They were, however, potted, and when fit, used as stocks for the original. Several trees on these stocks were planted against a south wall, where they grew rapidly. The trees have produced better fruit this year than formerly, probably owing to unusually high temperature in July.

The flowers are large; the leaves of the petals deeply coloured. Leaves crenated, with reniform glands. Fruit very large, 10 inches or more in circumference, roundish, and very handsome; pale yellow where shaded, and delicate crimson red next the sun. The flesh is pale yellow next the skin, but very deep red at the stone, to which it is attached by strong fibres, yet it is not everywhere adherent like the flesh of the cling-stone peaches. It is juicy and rich, but it requires to be gathered a day or two before it is used. In this state some gentlemen preferred it to old esteemed sorts. It ripens about the same time as the Bellegarde. The tree is a good bearer.

Buds of this sort have been distributed to the various nurserymen or other Fellows of the Society who applied for them. It must however be observed, that it requires a good aspect, and warm situation. It would probably answer for forcing, with plenty of heat. Some buds of it were sent to Paris, and there its fruit is said to be splendid. Like all large fruited varieties it ought to be well thinned.

NEW PLANTS, ETC, FROM THE SOCIETY'S GARDEN.

1. Sedum purpureum. *Link*, *Enum. Hort. Berol.*, I. 437. *Ledebour*, *Fl. Rossica*, II. 181.

Received from J. Gent, Esq., in April, 1852, under the name of Sedum purpurascens.

By many writers this is regarded as a mere variety of Sedum Telephium, and their opinion is probably correct. It only differs in being pervaded by a very deep purple tint, and in the leaves being wedge-shaped and narrow at the base, instead of being oblong and rounded at the base. The petals also are flat, not channelled at the point, and the stamens are rather longer than the petals.

It grows naturally in middle Russia, and all over Siberia, whether in the Altai, the Ural, or the Baical, reaching even to Kamtchatka.

In cultivation it is a hardy plant, growing 18 inches in height in any good light rich soil. It is increased by dividing the old plant in the ordinary way. It flowers in August. It is a rather showy and desirable plant for rock-work in summer.

2. Pelargonium foliolosum. *De Cand.*, *Prodr.*, I. 653. Geranium pinnatum. *Andrews*, *Bot. Repos.*, t. 311.

Purchased from Mr. Wicks, a collector of Cape plants, May 3rd, 1852, as a Yellow Pelargonium.

This is one of the fleshy-rooted species, often called Hoareas. It has hairy pinnated leaves, with about 7 pairs of ovate entire leaflets, and an odd one, which is much broader and rounder. The flower stem grows higher than the leaves, and divides into two unequal arms about the middle; of these, one flowers some weeks before the other. The umbels consist of 6 or 8 blossoms, with hairy stalks 3 times as long as the subulate bracts. The petals are linear, channelled, recurved, blunt, pale clear buff, the two upper standing nearer to each other, and with a deep crimson spot in the middle.

This was obtained for the sake of its yellow flowers, which it is hoped may be made to change the colour of some of the large-flowered Pelargoniums. As the pollen is good, this may happen.

It is a tuberous plant, requiring a good rich sandy soil, and to be treated like the ordinary kinds of Pelargoniums; but it must be kept rather dry in winter.

As has been stated, its value will be as a breeder; the flowers are too insignificant to render it of importance otherwise in a gardening point of view.

3. Vanda longifolia. *Lindley's Genera and Species of Orchidaceous Plants*, p. 215.

Presented to the Society by the Honourable Court of Directors of the East India Company in 1847. Flowered Sept. 3, 1852.

This is a very fine looking plant when not in flower, with deep green distichous leathery wavy leaves, as much as a foot and a half long and 2 inches wide, obliquely rounded at the end. Its habit is almost that of Angræcum eburneum. Very thick greyish-green roots protrude from its stem, and have a tendency to branch wherever the first point is injured. But the flowers are insignificant, very much like those of Vanda multiflora in form and colour, except that they are paler; they, however, have a pleasant perfume. These flowers appear in a corymb at the end of a short stiff ascending peduncle not one quarter the length of the leaves; they are very fleshy, and are banded with red upon a dull yellow ground; the lip is white. Inside the pouch of the lip are numerous yellowish hairs, concealing an erect fleshy plate, which partially divides the hollow of the lip into two halves.

It is not worth cultivating for the flowers, but the foliage is very fine, and serves to set off other Orchids.

4. Astragalus ponticus. *Pallas, Astragalogia*, p. 14, t. 11.

Raised from seeds received from H. C. Calvert, Esq., of Erzeroom, March 26th, 1850.

A decumbent perennial of a bright lively green colour. Stems about 2 feet long, slightly downy. Leaves almost smooth, of the texture of the Garden Pea, about a foot long, composed of 17 or 18 pairs of ovate-oblong, obtuse, or emarginate leaflets. The flowers are bright yellow, in nearly sessile ovate heads, with short calyx tube, much less hairy than in the allied species.

The cultivators of hardy herbaceous plants will understand what this is when it is compared with *Astragalus alopecuroides*, which it is a good deal like.

It is a hardy, half-shrubby plant, growing freely in peat-soil,

and flowering in August. Though not showy, its fine foliage renders it well adapted for shrubberies, coarse rockwork, and flower borders, devoted to the cultivation of the rougher kind of perennials.

5. Tillandsia stricta. *Botanical Magazine*, t. 1529.

Received from Miss Croker, of Chiswick, February 23rd, 1852, said to be from Rio.

This is a small Pine Apple-like plant, about 6 inches high when in flower. The leaves are very narrow, channelled, mealy, stiff, terminating in a long drawn-out point, and curved backwards till their ends are below the base of the plant. The flowering stems are shorter than the leaves, curved downwards, clothed with small green leaves resembling those below them. The flowers are collected into oblong cones, formed of shining, naked, roundish ovate, convex, imbricated bracts, the lower of which have a leafy point. Two varieties were observed, one with bright rose-coloured bracts and blue flowers, the other with greenish bracts and white flowers.

Among the less important inhabitants of the stove this may be regarded as a useful little plant, growing best in a warm moist air, attached to a block of wood, where it flowers in August.

6. Echeveria quitensis*—Sedum quitense. *Humboldt, Bonpland, and Kunth, Nov. Gen. and Sp.*, pl. 6, 46.

Received from Isaac Anderson, Esq., of Edinburgh, in August, 1851.

A bright green smooth succulent plant, forming stiff erect stems about 6 inches high, clothed by imbricated spathulate leaves, with an almost circular base attached to the stem only by one bundle of fibro-vascular tissue. The flowers are in stiff close erect racemes, shorter than the lower bracts, which resemble in form the leaves, but taper less to the base. Sepals 5, longer than the pedicel, equal, linear, acuminate, rather shorter than the corolla, which forms a scarlet five-sided pyramid, opening very slightly at the end into 5 acuminate lobes. Of the 10 stamens, 5 stand in furrows of the petals, and 5 are distinct.

This is evidently an Echeveria, as De Candolle surmised, and not a Sedum. During the summer it does very well on rockwork out of doors, but it is probable that it should be treated

* E. *quitensis;* omnibus partibus nuda, caulibus imbricatim foliosis, foliis spathulatis apiculatis, sepalis linearibus acutissimis æqualibus suberectis corollâ subclausâ brevioribus.—J. L.

Echeveria quitensis.

as a greenhouse shrubby succulent plant, requiring the same kind of soil and treatment as Echeverias. It is easily increased by cuttings, and seeds, which it ripens abundantly.

When grown out of doors, though pretty, it is not a very striking plant. It flowers in August. How it will look in a greenhouse is not ascertained as yet.

7. Gaura Lindheimeri. *Engelmann, in Boston Journal of Natural History*, Vol. V. p. 217. *Vilmorin, in Revue Horticole*, 3. ser. V. 41. t. 5.

Raised from seeds received from M. Vilmorin in April, 1850.

A branching herbaceous plant, growing from 3 to 4 feet high, and producing an abundance of gay white and reddish flowers during all the latter part of the year. The branches are long, rod-like, naked except at the extremities where the flowers grow. The lower leaves are deeply divided in a pinnatifid or sinuate manner; the upper are lanceolate and slightly toothed, the uppermost of all are linear-lanceolate and entire. The flowers appear in long virgate spikes, which frequently branch near the end. The petals are pure white; the flower-buds are long and slender, green when young, a warm reddish brown just before expansion. The seed-vessels are small sessile four-cornered nuts.

A perennial, growing freely in any good garden soil, and flowering from July to September. It is easily increased from seeds, and is best treated as a half-hardy biennial. It will not flower before the second season. Having been found in Texas or provinces more to the southward, it cannot be regarded as perfectly hardy. It is really a showy although a straggling plant, and well suited for decorating mixed beds of flowers, or the skirts of a plantation in the autumn.

8. Oncidium tenue. *Lindley, supra*, vol. iii. p. 76.
Var. *grandiflorum*.

Received from G. U. Skinner, Esq., in April, 1849, from Guatemala.

This has so very much the structure of Oncidium tenue that it can only be regarded as a variety; but it is one of greater beauty than the original. The panicle is much more branched; the flowers are larger, paler, with two distinct triangular spots at the base of the lip instead of broken blotches. The wings of the column are, moreover, strongly toothed, and the base of the lip is wider. The singular thinness of the pseudo-bulbs and the

Oncidium tenue

short broad thin leaves render the species among the easiest to recognise.

In the accompanying figure *a* represents the plant reduced in size, *b* the back and *c* the front of a flower of the natural size, and *d* a cross section of a pseudo-bulb to show its thinness.

It requires to be potted in fibry peat, and with a small portion of half-decayed leaves, must be perfectly drained, and kept in the coldest part of the stove. It is increased in the usual way when the plant is large enough for that purpose. It flowers in April and May. It is one of the best of the small kinds of Oncidium, remaining rather long in bloom.

9. Cinchona calisaya. *Weddell, Hist. Nat. des Quinquinas*, p. 30, tt. 3 and 4.

Raised from seeds received from the administration of the Jardin des Plantes of Paris through J. B. Pentland, Esq., on 17th of October, 1848.

Leaves oblong, obtuse, pale dull green, tapering gradually into the petiole, which is red, as well as the midrib itself; at the back of the leaf, in the axil of each principal vein, is a small excavation closed up by hairs. The stipules, which fall off very early, are a pair of oblong, erect, blunt, smooth plates. The flowers appear in panicles at the ends of the lateral shoots, are of a pale pink colour before expansion, almost white when fully open, and emit a most agreeable weak balsamic fragrance. The calyx is a small superior 5-toothed cup, covered with fine close down like the branches of the panicle. The corolla has a cylindrical tube about ½ inch long, and a reflexed 5-lobed limb, copiously fringed with long transparent club-shaped hairs. The stamens are 5, and can just be seen when looking down into the tube of the corolla.

Dr. Weddell, in his Natural History of the Quinquinas, gives a very full account of this important plant, from which the following are extracts :—

"From this species is obtained the most precious of the Jesuit's barks used in medicine, employed from time immemorial in trade under the name of Calisaya bark, but whose origin was wholly unknown till now."

"I have already observed that this tree has hitherto been only found in Peru, in the southern part of the province of Carabaya. The results at which I have arrived in endeavouring to determine exactly the limits of the region it occupies seem curious enough to be noted in this place. Thus, after having studied the plant in all the ancient province of Yungas in La Paz, to the north of 17° S. lat., I followed it into that of Lare-

caja or Sorata, thence into Caupolican or Apolobamba. the place of its first discovery; and all my care has failed in enabling me to find it north of those points. An imaginary barrier exists then beyond which the plant will not go, notwithstanding that the neighbouring valleys appeared to be of the very same nature; a fact that can scarcely be explained, unless upon the supposition that peculiarities do exist in the most southern valleys of Carabaya which are wanting in the north; and this may possibly be owing to the manner in which the rivers are distributed. I believe, in fact, that I am justified in referring those of the district in question to a particular system, possibly dependent upon the Bolivian system, and that those in the other parts of the province lose themselves on the contrary by the N. of Peru, in the Upper Amazon. This unexplained attachment which certain plants manifest for natural regions, and especially for valleys, is by no means without example; and now that Geographical Botany is obtaining serious attention, science will be enriched more and more with analogous facts."

"The great reputation of the Quinquina Calisaya has caused such a demand for it, that it will certainly some day disappear completely from commerce, and we shall be obliged to be content with other sorts now despised. It has already disappeared around inhabited places, except in the form of a bush; and if by mere chance a small tree has remained unobserved in the midst of a forest, its head no sooner becomes visible than the hatchet brings it down. For my own part, when I have wished to see the species in all its vigour, it has been necessary to pass long days on foot in the forests, to penetrate them by paths which were scarcely passable, and to undergo some of the fatigues which are the ordinary lot of the poor Cascarilleros."

"Some idea may be formed of the immense consumption of the bark of this plant, from the fact that the Bolivian Company exports annually, exclusive of adulteration, more than 4000 quintals. It is difficult for the forests to supply for any long time so large a demand."

Its native station was found by this enterprising traveller to be on the slopes and precipices of mountains as high as 4500 or 5400 feet in the hottest valleys of Bolivia and Southern Peru, in forests between 13° and 16° 30′ S. lat., and 68°—72° W. long., in the Bolivian provinces of Enquisivi, Yungas, Larecaja, and Caupolican, and in Carabaya in Peru.

This plant has been found to require very peculiar management. Mr. George Gordon, under whose care it flowered in the Society's Garden, states the following to be the manner in which the specimen was treated which bloomed so abundantly in the Society's stove:—

The seeds, when received from Mr. Pentland in the middle of October, 1848, were sown in shallow pans, well drained, in a mixture of equal parts of sandy loam and fibry peat, and placed in a close warm pit, remaining for ten days without receiving any water after sowing. Afterwards they were slightly sprinkled as the soil became dry on the surface, and at the end of about three months of such treatment the young plants began to make their appearance, in the latter part of January. When the seedlings had made a couple of rough leaves they were carefully removed, and placed singly in three-inch pots (small sixtys), potting them in a mixture composed of equal parts of sandy loam, fibry peat, and well decayed leaf mould, and after a copious watering were returned to the close pit, where they soon began to grow freely. When the young plants were well established a moderate portion of air was given over head, by pushing down the light a little at the top; and this treatment was continued until the latter part of the following autumn, when the plants were removed to a close pit with rather a drier atmosphere, more light, and a temperature from 50° to 55° by night. Subsequently the plants were shifted as they required it into larger pots, using the same kind of compost as before. As the specimens grew up they showed little tendency to form lateral branches, but became straight stemmed with hardly a side shoot. To counteract this as much as possible, I endeavoured to cause the plants to become bushy, first by pinching off the leading points of two plants while in a very young state; but that operation threw the plants into a bad state of health, and one of them eventually died. The other plants were allowed to grow for another season, and when the wood became hard or ripe, two more had their leading points removed, but with little better success. The remainder had at the same time their leading points tied down in a circular form, which in most cases caused the plant to throw out lateral branches. When the wood of these laterals again became firm, or what is termed about three-parts ripe, they were again tied down and allowed to remain so until the wood became set in a curved form, after which the ties were removed and the plant allowed its full motion, for I found if the branches were kept constantly tied down the plants became unhealthy, and in some cases even perished. By a continuation of this treatment I obtained the fine plant which flowered in the Society's Garden, having twelve panicles of flowers on the points of the lateral branches by the first week in September, 1852.

In cultivation I find this plant is easily injured by exposure to dry or cold draughts of air, for it is very impatient of direct currents and bright sunshine. For the Calisaya, as for many other plants which are difficult to manage in cultivation, nothing is

better than plunging their pots in a very gentle bottom heat to keep the roots moist and warm, and in an equal temperature, and to give air from overhead, shading also during bright sunshine. No method of giving air or putting the air in motion surpasses that of opening the lights above the plants at top, for no sooner is the light let down than the stream of heated air which rushes out is forcibly met by the cold air endeavouring to enter, the result of which is a proper medium of heat and moisture. It is very injurious to such plants as the Cinchona Calisaya to admit direct currents of cold air on a level with or below the plants. It is sure to rob the atmosphere of its moisture first and the plant afterwards, and by so doing causes the plant to flag; no plant, indeed, can thrive when acted upon in such a manner either by cold or dry air. This is one of the principal things to be observed in the management of the "Calisaya." A moderate degree of heat and moisture are essential points, provided the moisture never becomes stagnant or the air over dry by heat, especially when the plants are making fresh growth and the leaves are young and tender. At other times when the plants have completed their growth a much drier and cooler atmosphere is desirable, provided the plants are not exposed to extremes of either droughts or colds for too great a length of time. In whatever state the plants may be, always avoid dry-air draughts.

In growing the "Calisaya" the most suitable climate would in general be that of a house, treated in the same way as one for Mexican and Guatemala Orchids, where it is easy to avoid too much heat and moisture during the season of rest, and to give a liberal supply of both, with ample shade, when making new growth.

The "Calisaya" is increased either by seeds treated as above stated or by small lateral shoots as cuttings, when half ripened or just before the young wood becomes of a brown colour. The cutting should be taken off with a heel, close to the previous growth, and placed in silver sand, with as many of the leaves upon the cutting as possible. The pot containing the cuttings must be plunged in a slight bottom heat, and be covered with a bell-glass, and afterwards treated in the usual way. The seeds should be sown whenever received, whether in mid-winter or at any other time.

This plant is too difficult to manage and requires too much attention to become very common, especially as it is not very showy when in bloom, although remarkably fragrant and singular for its panicles of small hairy white flowers, slightly tinged with blush on the outer side, in form much like those of the common Lilac.

It commences flowering about the end of August, and will con-

tinue in succession at least a month, each flower lasting only two days, after which time it drops off before fading.

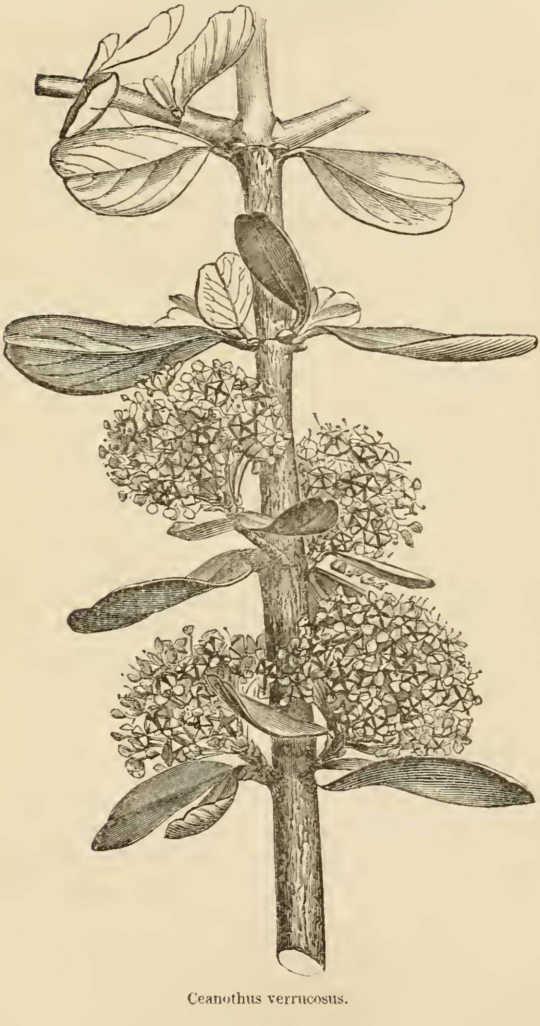
10. Ceanothus verrucosus. *Nuttall, in Torrey and Gray, Fl. N. Amer.*, i. 267 ; *Hooker, in Bot. Mag.*, t. 4660.

Raised from seeds collected by Hartweg in California, and received at the Garden, June 5th, 1848, as "a shrub 8 feet high, growing on the Santa Cruz mountains."

This proves to be a hardy evergreen of the best kind. It forms already a large bush, and will probably become a tree with long stiff rod-like downy branches, covered in winter with multitudes of large oblong or roundish brown buds. The leaves are opposite, roundish oblong, either slightly notched or entire at the end, scarcely an inch long at the largest, flat, deep green, shining, with grey hairy pits distributed over all the under surface. Occasionally, when the plant is young, they are coarsely toothed, as is represented in the Botanical Magazine ; but that is an exceptional state : the usual condition is what is shown in the annexed cut. At the base of each leaf is a pair of stipules, which gradually lose their thin extremities and change into soft fleshy conical prickles. The flowers are very pale blue, produced in great abundance in dense corymbs at the end of very short stiff lateral branches.

This shrub is among the most easy of plants to grow, and seems indifferent to climate or soil. It is increased by cuttings of the half-ripened wood, placed in sand under a hand-glass in a north aspect about the end of August. It is, however, best propagated by layering in the autumn. It flowers in June.

It may be added that with the single exception of *C. cuneatus*, a white-flowered species of little beauty, all the Californian Ceanothuses prove to be hardy near London. It is only requisite that they should not be placed in soil which keeps them growing till late in the year, but that their wood should be well ripened. In the Botanical Magazine Sir Wm. Hooker, in speaking of *C. rigidus*, observes that—"The North-west American *Ceanothuses* are particularly deserving of cultivation in the open ground ; but it may require a Devonshire climate to bring them to the state in which they are at Bishopstowe, as just announced to me in a letter, dated 27th May, 1852, of the Bishop of Exeter. 'The *Ceanothus divaricatus* is now in its highest beauty : the largest plant is eighteen feet high, eighteen feet wide, twelve feet deep (*i. e.* from back to front), covered with thousands of the beautiful thyrsoid flowers, so that the leaves are hardly visible. *C. rigidus* blossomed about six weeks ago ; *C. dentatus* is now in full flower ; *C. papillosus* is just coming into flower ; *C. azureus* will not blossom before August.'"



Ceanothus verrucosus.

11. Lopezia macrophylla. *Planchon, in Flore des Serres*, VII. 709, t. 23, p. 177. Jehlia fuchsioides. *Hort. Germ.*

Received from Messrs. Rinz, of Frankfort, in April, 1852.

This is a soft smooth pale green shrub, with a fleshy tuberous root, like some Fuchsias. The leaves are stalked, almost wholly smooth, oblong-lanceolate, acuminate, narrowed to the base, where they terminate abruptly in a rounded manner, strongly serrated, and furnished with deep lateral diverging veins, which give the leaves the appearance of a Hornbeam tree's ; at the base they are furnished with a pair of red pyramidal short glands. The flowers stand on long slender stalks, singly in the axils of leaves, are as large as those of a Fuchsia globosa, and of a very deep rose colour, which pervades every part except the anther, which is blue.

At first sight this plant would not be taken for a Lopezia, the sepals being altogether petaloid, and the glandular knee peculiar to two of the petals of the genus seeming to be absent. But it will be found upon a careful examination that the knees are really present, only they stand very low down on the petals, so as to be concealed by the other parts.

The name here employed, but with some doubt, is that under which M. Planchon has given it in the *Flore des Serres*. It seems impossible that it can be the plant which Mr. Bentham first described as Lopezia macrophylla, in the Plantæ Hartwegianæ, a shrub with downy leaves and terminal panicles of flowers. That species I suspect exists in the Society's Garden, from Mr. Skinner, but, not having flowered, cannot at present be identified. Till materials accumulate for the satisfactory settlement of this question the name employed by M. Planchon had better stand unchanged.

It is a green-house soft-wooded shrub, growing freely in a mixture of sandy loam and leaf mould, and requiring the same treatment as a Fuchsia. It is increased by cuttings put in sand under a bell-glass, and flowers during winter and spring.

It is likely to be valuable as a winter flowering plant, notwithstanding that it is coarse in foliage and habit.

12. Senecio concolor. *De Cand., Prodr.*, vi. 407.

Received from Sir Charles Hulse, Bart., in August, 1852 ; said to have been raised from seeds sent from the Cape of Good Hope by Colonel G. Buller.

We have little doubt that this fine showy perennial is that

which De Candolle meant by his *S. concolor*, from Tulbagh and the Kat River mountains, although in cultivation it scarcely produces any of the hairs to which his specific character points. It is evidently a near relation of the old Senecio speciosus. The root leaves are spathulate, lanceolate, long-stalked, sinuated towards the base and toothed; the leaves next above them are oblong and stalked; the highest are sessile, and slightly stem-clasping and downy at the edges; all are more or less incised. The stem grows about 2 feet high, and forms an open corymb scantily clothed with foliage. The flower-heads have a rich purple colour throughout, with a diameter of nearly two inches, most of which belongs to the rich purple ray.

It is a greenhouse herbaceous plant, and requires to be treated like Cape Pelargoniums. It grows freely in a mixture of loam, peat, and leaf mould, and is increased from seeds. It is a very handsome plant, in the way of a "Cineraria," and may prove useful for bedding out during the summer. It flowers in August and September.

13. CHRYSEIS (ESCHSCHOLTZIA) CALIFORNICA; var. *albiflora*.

Raised from seeds received from M. Vilmorin, as "Eschscholtzia californica à fl. blanches," and from Mr. Charlwood as a "new white Eschscholtzia," in February, 1852.

This plant is hardly distinct from the Eschscholtzia, or Chryseis californica, but it is remarkably different in having pale cream-coloured flowers, which are somewhat smaller. Like that species it must be sown in the open border in the spring, and treated as a hardy annual. It is a very nice hardy plant, flowering all the summer.

14. OPHIOXYLON MAJUS. *Hasskarl, in Walpers' Repertorium*, vi. 467.

Received from Dr. von Siebold, August 18th, 1850, under the name of Ophioxylon album.

There has been a difference of opinion among botanists whether there are one or two species of Ophioxylon; but the question would seem to be set at rest by Mr. Hasskarl, who describes this plant as being altogether stronger in growth, with a smooth shrubby stem 4 feet high, leaves green beneath, white flowers, and olive-shaped fruit, while in *O. serpentinum* this plant does not grow above a foot high, is not a shrub, has leaves red underneath, larger reddish flowers, and globose fruit. The large

white flowered plant, *O. majus*, thought by Hasskarl to be possibly the Ophioxylon album of Gerstan, forms in the stove a small light green shrub with oblong-lanceolate membranous leaves placed in threes or fours, and loose cymes of white flowers. The corolla is nearly three quarters of an inch long, with the lobes of the limb half circular.

It is a stove shrub, growing freely in a mixture of sandy loam and peat; but requires to be kept in rather a moist atmosphere. It is increased by cuttings put in sand under a bell glass, and plunged in the bark bed. Flowers in April and May. The plant is of little value in a horticultural view, the white flowers being too small to produce a striking effect. It is however of some medical interest, being one of the plants whose roots are believed by Indian practitioners to be a cure for the bite of venomous serpents.

15. CENTRANTHUS MACROSIPHON. *Boissier. Paxton's Flower Garden*, vol. ii. t. 67; var. *albiflora.*

Raised from seeds received from M. Vilmorin, January 1852.

This differs in no respect from the original long-flowered Centranth, except in its flowers being pure white. It is a good hardy annual, growing freely in any good rich garden soil, and increased by seeds sown either in the autumn or spring, in the open border. It flowers in July and August.

16. CALCEOLARIA CHELIDONIOIDES. *Humboldt, Bonpland, and Kunth, Nov. Gen. and Sp., pl.* 2, 378. *Bentham, in De Candolle's Prodromus*, 10, 204.

A plant was received from Isaac Anderson, Esq., of Edinburgh, Oct. 16, 1850.

A decumbent, branching, entangled, viscid, hairy, brown-stemmed annual. Leaves pinnated, with pedicellate lanceolate incised divisions, the uppermost ternate, the lowest of 3 or 4 pairs with an odd leaflet very much larger than the others. Flowers in pairs, in the axils of every one of the upper leaves, on slender stiff stalks covered closely with spreading brown glandular hairs, as also is the calyx, the lobes of which are incised. Corolla hairy externally, small, but a brilliant pure yellow; its upper lip hardly so long as the calyx, the lower lip obovate and nearly sessile. Anthers with the connective in the form of 2 horizontal arms, forming a right line at right angles to the filament; the back arm concealed beneath the upper lip of

the corolla and antheriferous; the anterior arm longer, hornlike, clear yellow, prominent, and sterile. Seeds very small, smooth, cinnamon-coloured, oblong, strongly ribbed.

A half-hardy annual; with the same kind of treatment as the small Blue Lobelias, it flowers all the summer and autumn, if planted in rather a moist situation.

It is very pretty, and a most abundant flowerer, well suited for planting in the American border.

17. Cerasus laurocerasus; var. *Pumilio.*

This is a curious dwarf variety, resembling the common Laurel in much the same way as the Clanbrazil Fir resembles a Spruce. The leaves are from 2 to 3 inches long, and the habit extremely dwarf. If it does not hereafter run away, it will be a useful variety for places where the common Laurel is too large.

A plant was received in 1851 from Lieut.-General Monckton, F.H.S., whose brother's gardener, William Reynolds, raised it from seed of the common Laurel.

18. Hedychium flavescens. *Loddiges, Bot. Cab.*, t. 723.

Received from Dr. Siebold in August, 1850, under the name of Hedychium Roxburghii.

A stout plant, about 4 feet high, with a great fleshy rhizome. Leaves about 15 inches long by 5 inches broad, covered on the under side with long silky hairs. Flower spike erect, a foot long, covered with brown hairs. Outer bracts rather distant, 2 inches long, with a short leafy revolute point, and closely covered with rusty hairs at the edges; rolled round a very short spike of 5 flowers, surrounded by membranous, nearly-smooth bractlets. Ovary and long tubular calyx shaggy with brown hairs. Tube of the corolla smooth, slender, 4 inches long; its 3 outer petals linear and revolute; of the pale yellow 3 inner, the lateral are unguiculate, spathulate-lanceolate, acuminate, slightly toothed; the lip is unguiculate, deeply 2-parted with half-oval divisions, about half the length of the bright orange-coloured filament. The flowers emit a very agreeable spicy fragrance.

It requires to be potted in a rich loamy soil, and to be placed in the dampest part of the stove while in a growing state; afterwards it should be removed to a cooler and drier place to bloom; after flowering it should be dried gradually, and rested for about a month. It blossoms in September.

It is a very fragrant plant, and rather showy, but remains only a short time in bloom.

There is no doubt about its being the *H. flavescens* of the Botanical Cabinet; but I should have thought it to be also *H. villosum* of Dr. Wallich, if that plant had not been described as having 5 linear petals, whereas here 3 only are linear and 2 broad spathulate-lanceolate.

19. Vincetoxicum japonicum. *Morr. and Decaisne, in Bull. Acad. Brux.* 1836, p. 17.

Received from Dr. Siebold, in August, 1850, under the name of Cynanchum flavescens.

A herbaceous plant, with a slight tendency to climb. The whole surface soft with down. Leaves roundish, oblong, mucronate, nearly sessile. Flowers few, pale greenish-yellow, in nearly sessile cymes, with slender pubescent flower-stalks.

A perennial, supposed to be hardy or half-hardy, growing best in the peat border, and increased by division of the roots when in a dormant state. It is, however, of no kind of horticultural interest. It flowers in July and August.

20. Myrica californica. *Chamisso and Schlechtendahl, in Linnæa*, vi. p. 535; *Hooker, Fl. Bor. Am.*, 2, 169; *Botany of Beechey*, p. 391.

Raised from seeds collected by Hartweg, in California; received at the Garden June 5th, 1848, and said to be collected in woods near Monterey, growing 12 feet high.

This was originally gathered by Menzies on the north-west coast of America. Douglas found it at Puget Sound. It forms an evergreen bush, with dense narrowly lanceolate, slightly serrated leaves, covered, especially on the under side, with transparent, glossy, saucer-shaped sunken scales, of microscopical dimensions, consisting of a layer of wedge-shaped cells, placed obliquely round a common centre. The flowers are green and inconspicuous, in short axillary spikes, which eventually bear from 1 to 3 small globular fruits, whose surface is closely studded with fleshy, oblong, obtuse grains of a dull red colour, and astringent flavour.

It is a hardy evergreen, growing freely in any good garden soil, increased by seeds or by layers, in the usual way. It flowers in July, and produces in September an abundance of its little granular fruits. In gardens it is an acquisition, being a hardy shrub, with fragrant leaves, and well suited for rock-work or for the front of a shrubbery.

Myrica californica.

21. Campanula Vidalii. *Watson, in Hooker, Ic. Plant.*, vol. vii. t. 684. *Moore and Ayres, Gardener's Magazine of Botany*, vol. i.

Raised from seeds received from Mr. W. P. Ayres, in February, 1851.

This species was first made known through Sir William Hooker's Icones, by Mr. Hewitt Watson, to whom it was given by Captain Vidal, R.N., whose name it bears. It was found on "an insulated rock off the east coast of Flores, between Santa Cruz and Ponta Delgada." Seeds were received some time since from Mr. Ayres, who was indebted for them to Mr. P. Wallace.

The plant has a fine handsome deep green shining succulent foliage, and forms a very good-looking decumbent shrub. Some of the shoots are merely terminated by long rosettes of leaves, others throw up an erect graceful, flowering stem, with a shiny surface, and a warm greenish-brown colour, terminated by several large white nodding flowers, each about 1½ inch long, and shining as if glazed. The colour is however bad, a tint of dull purple or even pale cinnamon giving them a dirty appearance.

It is a half-hardy or greenhouse shrub, growing best in a mixture of sandy loam and leaf-mould, increasing freely by seeds, but not flowering before the second season from seed. It blossoms in August, and is a good object for rock-work in a climate which suits it; but, being tender, its value is much diminished, independently of the dingy colour of its flowers.

This plant has so little the appearance of an ordinary Campanula that it is a question whether it truly belongs to the genus. It would rather seem to be related to *Musschia*, the old *Campanula aurea*, though by no means to be associated with it. The ovary is 3-celled, with a great rugged double placenta expanding in each cavity, and around the flat head of the ovary, inside the corolla, there runs a broad yellow fleshy ring-like disk; but neither in this nor in any other circumstance, except habit, does there appear to be real ground for generic separation.

22. Vincetoxicum purpurascens. *Morren and Decaisne, in the Bull. Acad. Brux.* 1836, p. 17.

Received from Dr. Siebold, in August, 1850, under the name of Cynanchum purpurascens.

Stems and all the green parts slightly downy; when in flower becoming weaker, with a tendency to twine. Leaves narrow, oblong, mucronate, becoming smaller near the ends of the shoots where the flowers appear. Flowers dull purple, on slender pedi-

Vincetoxicum purpurascens.

cels, in long-stalked, many-flowered cymes, proceeding from the axils of the superior leaves, the size of, and very much like, the common Vincetoxicum nigrum.

This perennial appears to be hardy, or half-hardy, like *V. japonicum*, growing with it freely in a peat border; but, although transmitted as a good garden plant, it must be consigned to the mere Botanical collector.

END OF VOL. VII.

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PROCEEDINGS AT MEETINGS OF THE SOCIETY.

Oct. 7, 1851. (Regent Street.)

I.—ELECTIONS.

Sir E. B. Baker, Bart., Renston, Dorset; Sir C. Ricketts, Bart., 42, Pall Mall; Sir J. Thorold, Bart., Syston Park, Grantham; H. Wilson, Esq., Stowlangtoft Hall, Suffolk; and Major-General Fox, Addison Road, Kensington.

II.—MEDALS AWARDED.

Banksian Medal:—

To Messrs. Veitch, of Exeter, for a new yellow flowered shrubby Calceolaria, from Peru. It was in the way of C. grandis, but it was more robust and larger in the leaf. Though not hardy, it was mentioned that it might be found worth while to winter it under protection for planting in the shrubbery in spring, where it would prove a pleasing ornament during the summer months. An opinion was also expressed that it would be useful in the hands of the hybridist for altering and improving the foliage of some of the finer flowered kinds.

To Messrs. Weeks and Co., King's Road, Chelsea, for a bloom of the Royal Water Lily (Victoria Regia), a bud of Nymphaea caerulea, and a flower and leaf of N. dentata, from an open pond heated in their nursery, in which such plants have been found to grow and flower successfully. The leaf of N. dentata was as large and fine as it could well have been in the best managed stove aquarium. It was stated that the Victoria had produced 50 blooms in the course of the past summer.

To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for four Queen Pine Apples, weighing respectively 7¼ lbs., 6 lbs. 14 ozs., 5 lbs. 15 ozs., and 5 lbs. 10 ozs. The heaviest, a remarkably fine fruit, was however scarcely sufficiently ripe.

To Mr. Elphinstone, Gardener to the Speaker, F.H.S., at Heckfield, for bunches of Black Hamburgh Grapes, well

swelled and ripened, though not very large, which were cut from vines raised from eyes that were only struck on the 10th of February last. It was stated by Mr. Elphinstone that the eyes when potted were intended for fruiting in 1852. He mentioned that on the 10th of February, 1851, the eyes were prepared and potted in 3-inch pots—one eye in a pot—and placed on the flue of a vinery, which he had commenced to force. In the course of a month the buds began to push through the soil, and required to be well supplied with water almost every day, in consequence of the strong heat arising from the flue, until they had reached the height of about a foot. At this stage the vines overhead shading them too much, they were removed to a pit furnished with bottom heat; they were shifted for the first time in the beginning of April, when they were plunged in a bed of leaves. When the vines had reached the length of 4 feet the whole of the leaders were pinched off with a view to induce fruitfulness as near the pot as possible. They were shifted into their fruiting pots in the second week in May. About this time eight of the strongest were selected from the young stock, when the whole of the buds were cut out to within six or eight of the bottom of the cane, the leaves being allowed to remain until the buds showed signs of again breaking out into leaf, when the whole of the eight canes were cut off within an inch of the uppermost bud. The result was, that on each cane they showed fruit, some account of which has just been given. One of the vines taken from the pot accompanied the fruit. It was everything that could possibly be desired; being well ripened, the buds full and large, and the foliage ample and of great substance.

Certificate of Merit :—

To Mr. Frost, Gardener to E. L. Betts, Esq., Preston Hall, Aylesford, for a Seedling Begonia, obtained by crossing B. cinnabarina with B. nitida, the result being a freer flowering plant than cinnabarina, with even higher coloured flowers than those of that fine kind, while the foliage was very nearly the same as that of nitida.

To Mr. Macintosh, Nurseryman, Maida Vale, Edgeware Road, for a very fine shrubby specimen of Common Mignonette (Reseda odorata). It was stated to have been a single plant pricked out into a pot last January, and shifted on till it had attained a large size. It was mentioned that Mignonette is not an annual, as many imagine it to be; but that it will become a woody shrub, and last for years,

provided it is well managed and kept free from frost and damp.

To Mr. Jones, Gardener to Sir John Guest, Bart., F.H.S., for a Ripley Queen Pine Apple, weighing 6 lbs. 3 oz.

To Mr. Frost, Gardener to Lady Grenville, F.H.S., for a Black Jamaica Pine Apple, weighing 5½ lbs.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

I. Anderson, Esq., of Maryfield, near Edinburgh, contributed cut specimens of a Seedling Veronica, which appeared to be less handsome than the same raiser's V. Andersonii. It wanted the charming mixture of violet and white which makes the latter so beautiful.

Mr. Kennedy, of Covent Garden, sent a narrow-leaved variety of Scolopendrum officinale from Yorkshire.

Mr. Stark, of Edinburgh, produced a purple and lilac flowered Portuguese Linaria, called Arabida, which was stated to be new to gardens.

From Messrs. Jackson, of Kingston, came half a dozen nice plants of Odontoglossum grande, which had been seven weeks in full bloom. Messrs. Jackson stated that this was effected by placing the plants, when the flower-buds were fully grown, in a cold but well-shaded, airy conservatory, where their beauty was enjoyable by those who could not venture into a hot and damp orchid-house. It was mentioned that this is one of the hardiest of exotic Orchids, and that it has been even bloomed out of doors during summer under the shade of a Laurel bush.

Mr. Rivers, of Sawbridgeworth, contributed some Strawberry plants in pots, illustrative of a new mode of preparing them for forcing. Their history, as given by Mr. Rivers, is as follows:—"About the second week in July the pots (6-inch ones) were filled with a compost of two-thirds loam and one-third rotten dung, as follows: three stout pieces of broken pots were placed in the bottom, and a full handful of the compost put in; a stout wooden pestle was then used with all the force of a man's arm to pound it, then another handful and a pounding, and another till the pot was brimful, and the compressed mould as hard as a barn-floor. They were then taken to the Strawberry-beds, and a runner placed in the centre of each, with a small stone to keep it steady. They were watered in dry weather, and they have had no other care or culture. For two or three years I have had the very finest crops from plants after this method, and those under notice promise well. If the pots are lifted, it will be ap-

parent that a large quantity of food is in a small space. I may add, that from some recent experiments with compressed earth to potted fruit-trees, I have a high opinion of its effect, and I fully believe that we have yet much to learn on the subject."

A Queen Pine Apple, weighing 5 lbs. 4 oz., was furnished by Mr. Fraser, Gardener to the Earl of Radnor.

Mr. Brown, Gardener to H. Minton, Esq., had a Ripley Queen Pine Apple weighing 4 lbs. 14 oz.

A dish of Black Hamburgh Grapes was exhibited by Mr. Rust, Gardener to J. Maclaren, Esq., F.H.S.

Examples of the same kind of Grape were sent by Mr. Fry, Gardener to Mrs. Dent, Manor House, Lee, Kent, to show the effect of sulphur in killing Vine mildew, which has been so prevalent of late years both in this country and on the Continent. Mr. Fry's mode of dealing with it is as follows. He says: "With reference to the Grapes exhibited by me, I may state that they were grown in what I term my third vinery, in which artificial heat is but rarely applied. The fruit in this house last year was fearfully attacked with mildew, which suggested in the first instance the diffusing of sulphur by more efficient means than had hitherto been employed, namely by the sulphurator. This season the Grapes in the same house were attacked as seriously as in the preceding year, but on perceiving the mildew make its appearance I instantly took prompt measures to subdue it. Being provided with my improved sulphurator, I diffused 'sulphur vivum' in a perfectly dry state throughout the house so as to finely but thoroughly cover both fruit and foliage. Fires were lighted and the temperature kept up to from 80° to 90°, ventilation being considerably diminished, and water in any form discontinued. After being subjected to this treatment for about four or five days the vines received a thorough syringing, which cleansed them from every particle of sulphur. With respect to the use of sulphur in killing mildew, many ladies and gentlemen with whom I have conversed consider it highly objectionable: they say that they do not like the idea of eating sulphur with Grapes, neither would any one, and I can prove to them that this need never be done, and, moreover, that the use of sulphur when timely and judiciously applied does not in any way deteriorate the fruit. I much question if the most practised eye could detect sulphur on the Grapes exhibited, although they have been twice covered with it; and as to the mildew itself amongst vines, I fear it no more than I do greenfly amongst cucumbers, which is so soon deprived of existence by the fumes of tobacco."

A round white Potato, called Prince Albert, was produced by

Mr. Wilmer of Sunbury. It was reported to be very early and prolific, being sometimes fit for use in six weeks from the day of planting.

IV.—NOVELTIES FROM THE SOCIETY'S GARDEN.

A French sulphurator. The great merit of this instrument is its simplicity and cheapness. It consists of a tin box for holding the sulphur, placed on the upper side of the pipe of a pair of common bellows. The sulphur gets into the pipe through small holes made for the purpose in the bottom of the box, and, in order that no stoppage may take place, a small hammer-head attached at the end of a slight steel spring is fixed on the under side of the bellows, a gentle tap from which, now and then, keeps up a continuous fall of sulphur into the pipe. These appliances, which may be attached to a pair of bellows for little more than 6*d*., answer every purpose for which they are intended, equally as well as a more expensive machine.

Accompanying this contrivance were bunches of Black Prince Grapes, which could only be produced free from mildew by early and repeated sulphurings over both leaves and fruit. From the latter the particles of sulphur may be removed in two ways—either by plunging the bunch in a tub of clear water, moving the bunch under the water so as to bring it up at a place free from the floating particles of sulphur; or the bunch may be syringed on all sides with a fine syringe. This is the method adopted in France, and it has been successfully tried in the Garden. The *bloom* on the berries is least disturbed by syringing downwards, or obliquely, as rain would fall.

V.—BOOKS PRESENTED.

The Journal of the Royal Agricultural Society, Vol. XII. Part 1. From the Society.
The Gardeners' Magazine of Botany for September and October. From the Publishers.
The Athenæum for August and September. From the Editor.
Statistique Horticole de Maine et Loire. From M. Le Gris.
Bulletins du Cercle Pratique d'Horticulture, &c. de la Seine Inférieure for 1850-51. From the Horticultural Society of the Lower Seine.
Archives du Muséum d'Histoire Naturelle, Tome V. Livraisons 1, 2, et 3. From the Museum of Natural History, Paris.

Nov. 4, 1851. (Regent Street.)

I.—ELECTIONS.

W. Banting, Esq., The Terrace, Kensington; H. Edwards, Esq., M.P., Halifax; Rev. John Thornycroft, Thornycroft Hall, Congleton; and Mr. John Keynes, Nurseryman, Salisbury.

II.—MEDALS AWARDED.

Large Silver Medal :—

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a very fine collection of Orchids, among which were two plants of Vanda tricolor, two of V. suavis, two fine specimens of Cattleya labiata, a striking variety of Lycaste Skinneri, Odontoglossum grande, Cymbidium giganteum, Calanthe vestita, Miltonia candida and violacea, and others, including a so-called new Oncidium and Odontoglossum.

Banksian Medal :—

To Mr. Forbes, Gardener to the Duke of Bedford at Woburn Abbey, for an exhibition of Grapes, consisting of a bunch of Muscat, weighing 2½ lbs., and three of Black Hamburgh, weighing respectively 2¼ lbs., 2½ lbs., and 5¼ lbs. The latter was, however, not one bunch, but a cluster of bunches all produced from a common point or bud.

To Mr. Martin, Gardener to Sir H. Fleetwood, Bart., for fine bunches of Oldaker's West's St. Peter's, a valuable variety for hanging long after it is ripe without shrivelling. The same exhibitor also showed Muscats, the produce of a second crop from the same Vines this year, and a dish of excellent Hamburghs.

Certificate of Merit :—

To Mr. O'Brien, Gardener to G. Reed, Esq., Burnham, Somerset, for a curious new form of Myanthus.

To Mr. Price, Gardener to W. Thompson, Esq., M.P., for a well-ripened Queen Pine Apple, weighing 4 lbs. 13 ozs.

To Mr. Davis, of Oak Hill, East Barnet, for beautiful examples of Muscat of Alexandria Grapes.

To Mr. Wooley, Gardener to H. B. Kerr, Esq., F.H.S., for Black Hamburgh Grapes, fair sized specimens, and perfectly ripe, from Vines that had been grown in what Mr. Rivers, of Sawbridgeworth, calls an "Orchard-house," *i. e.*, an unwarmed roughly constructed shed with a glazed roof. It was stated that there had been an abundant crop in this house, without any mildew, and that such places had been found very useful in winter for keeping Orange-trees, Aloes, Fuchsias, or other half-hardy plants that require little water.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

A punnetfull of some late Cherry, resembling a highly-coloured White Heart, was furnished by the last-named exhibitor. They were not large, but good fruit for the time of year. They had been gathered from a dwarf tree in the open ground, where no protection whatever had been afforded them. The same gardener also sent fruit in good condition of the "large monthly bearing Raspberry," which was stated to have yielded a succession of fruit from August to November, and, if kept dry, even till October.

Among other subjects, Mr. Wooley sent blooms of the charming terrestrial Orchids called Pleione (Cœlogyne) Wallichii, and maculata, which he stated were two most useful plants for winter decoration. A specimen of the former, which had been grown in a 6-inch pot, was reported to have had 15 flowers on it, all open at one time, and which lasted in perfection from three to four weeks.

Messrs. Veitch produced a slender-growing white Dendrobe (D. album), and Pleione (Cœlogyne) lagenaria. The flowers of the latter resemble those of P. maculata, except that they are larger, and that the sepals, petals, and outside of the lip are pink instead of white.

Mr. May, Gardener to Mrs. Lawrence, F.H.S., furnished a large and very fine Crowea saligna, together with the Yellow Chorozema (C. flavum).

Mr. Salter, F.H.S., contributed Pentstemon variabilis, a pale greenish white kind, tipped with cherry.

Messrs. Weeks again sent a bloom of the Royal Water Lily (Victoria Regia), one of Nymphæa cærulea, and a flower with a leaf of N. dentata, still from the open heated pond in their nursery.

A variety of curious evergreen shrubs and trees were contributed by the Hon. W. F. Strangways, from his garden at Abbotsbury, near Dorchester.

IV.—NOVELTIES FROM THE SOCIETY'S GARDEN.

Some nice Daisy-flowered Chrysanthemums, which had been received from M. Van Houtte of Ghent.

Along with these came a collection of Apples and the following Pears :—

Napoléon.—From a wall.

Forelle.—This proves to be a good bearer; and although the tree blossoms earlier than almost any other, yet it has withstood

the frosts, which destroyed the best blossoms of other kinds in the last two springs.

Beurré de Capiaumont.—From a standard.

Beurré Bosc.—From a standard.

Van Mons Léon le Clerc.—This is a valuable Autumn Pear, well deserving of cultivation, in the southern counties at least: it is necessary to state, however, that it will not succeed on the Quince stock.

Hacon's Incomparable.—This is an excellent Pear from a standard, and from such it will keep till January; but from a wall it scarcely keeps till this time, giving way rapidly at the core.

Figue de Naples.—The flavour of this resembles that of the sort called the Bishop's Thumb, which many prefer. The tree is a good bearer, and the fruit, though ripe, bears carriage well.

The Apples were well known kinds, with the exception of the Eldon Pippin, a new sort, which merits cultivation.

The following notice of an alteration in the By-Laws was read for the first time:—" It is proposed to repeal the following By-Law of the Society, viz., Chapter 4, Art. 8, ' Every Fellow may at any time compound for all his future annual contributions by paying ten times the amount of his annual subscription;' and to substitute the following words, ' Every Fellow may at any time compound for all his future annual contributions by paying, when first elected, 42*l.* 10*s.*; at the end of seven years, 31*l.* 10*s.*; at the end of fourteen years, 26*l.* 5*s.*; and at the end of twenty years, 21*l.*' "

V.—BOOKS PRESENTED.

The Athenæum for October. From the Editor.
The Quarterly Journal of the Geological Society, Vol. VII. No. 28. From the Society.

Dec. 2, 1851. (Regent Street.)

I.—MEDALS AWARDED.

Knightian Medal:—

To Mr. Ingram, C.M.H.S., Gardener to Her Majesty at Frogmore, for a beautifully formed smooth-leaved Cayenne Pine-apple, weighing 8 lbs. 4 oz.

Banksian Medal:—

To Mr. Dodds, Gardener to Colonel Baker, F.H.S., for a smooth-leaved Cayenne Pine, weighing 5 lbs. 13 oz. Along with it came a new kind, called Charlotte Rothschild's Pine-apple, concerning which Mr. Dodds stated that "it was a sort which Colonel Baker purchased

from M. de Gontier, near Paris, in June, 1850. The fruit resembles the smooth-leaved Cayenne, but in growth the plant is very much like a strong-growing Queen." Mr. D. adds, "It will prove to be a good winter sort. The smooth-leaved Cayenne sent is from a plant not quite sixteen months old, and now that the fruit is cut, the plant, with all the roots attached, weighs 6 lbs., and a sucker taken from it weighed 2¼ lbs. We grow all our plants in loam and rough peat, planted out over troughs."

To Mr. Higgs, Gardener to J. Barchard, Esq., F.H.S., for a very fine cluster of the fruit of Musa Cavendishii. The bunch consisted of upwards of 90 fruits, most of which were ripe, and upon some of them being cut up and tasted they proved to be very good. This was from the dwarf variety of this Musa.

Certificate of Merit:—

To Mr. Povey, Gardener to the Rev. J. Thornycroft, F.H.S., for a Black Jamaica Pine-apple, weighing 4 lbs. 9 oz.

To Mr. Snow, Gardener to the Earl de Grey, F.H.S., for a very pretty hybrid Epiphyllum, which was stated to have been raised between E. Russellianum and E. truncatum; it was deeper in colour and better shaped than either of its parents.

II.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Models of proposed glass walls, the invention of Mr. Ewen, gardener to O. F. Meyrick, Esq., F.H.S., Bodorgan, Anglesea. These consisted of a line of flat iron uprights, nine feet high, firmly secured to the ground so that no displacement might be possible. The edges of these uprights were pierced with holes, through which wires were stretched horizontally whereon to train branches. At the distance of a foot from both faces of the uprights a perpendicular sash of glass was erected. The sashes were housed in with a glass coping, so constructed as to throw water off into gutters prepared for its removal. Finally, the upright sashes had a free motion to the right or left, in order that every part of the trellis work might readily be uncovered, and made accessible. In fact, the glass wall will be a glass case 9 or 10 feet high and about 2 feet thick, perfectly transparent, within which all manner of plants may be trained in the espalier form in a double line, one line facing the south, the other the north, or otherwise, according to the direction of the wall. It was mentioned that one of these glass walls, from which much is expected, was to be

erected in the Garden of the Society, where its merits will be fully tested and reported on.

Mr. Salter, F.H.S., Hammersmith, sent a collection of Pompone Chrysanthemums in a cut state, the produce of crosses between Mr. Fortune's Chusan Daisy and some of the larger flowered kinds.

A Black Jamaica Pine-apple, weighing 3 lbs. 9 oz., was shown by Mr. Bundy, Gardener to Lord Dynevor, F.H.S. "It was grown in a house where the bottom heat of the plunging bed is supplied by a common brick-built Polmaise stove, the flue from the furnace running round the house to supply top or atmospheric heat, a system of warming pine-houses which has been found to answer admirably here."

Grapes, attached to the branches, shrivelled, and in the condition of raisins, but showing that they had perfectly ripened, were exhibited by J. Hogg, Esq., of King's Bench Walk, Temple. "I have sent," says Mr. Hogg, "a branch of a Vine bearing grapes, which I succeeded in ripening perfectly in the *open air*, in a very northern district of England, viz., about 54° 35′ N. lat., at Norton, distant two miles north of Stockton-on-Tees. During the greatest part of half a century I have never witnessed grapes that had been ripened there out of doors; indeed, the three or four vines, trained to south sides of houses, which I know of in that neighbourhood, have never, to my own knowledge, matured their fruit; and this is fully confirmed by the late able botanist, Mr. N. Winch, of Newcastle-on-Tyne, who for very many years resided there, and was fully acquainted with the horticulture of the north of England. He records in his interesting 'Essay on the Geographical Distribution of Plants through the Counties of Northumberland, Cumberland, and Durham' (2nd edit., 1825, p. 16), that 'the Vine seldom flowers; and if by chance small grapes are produced, they soon drop off.' The Vine which bore the grapes exhibited is the Black Cluster; for several years it was cultivated in my hothouse, where it always ripened much fruit. Two or three years since I dug it up, and planted in its stead a newer sort of vine; and as I wanted to ascertain whether, in a favourable season, it would continue to bring forth grapes, and at all ripen them out of doors, I placed it against a south brick wall, having first cut it down to nearly a third of its height. It had not grown again sufficiently tall until this year so as to overtop an adjoining holly-tree, which had previously overshadowed it. I was glad to see that it flowered freely in July last. The grapes became perfectly formed in August, and I first noticed that a few berries here and there began to change colour on September 18th. In October the many bunches had become a

rich purple or purplish-black colour, though, owing to neglect in the proper thinning of them, and to the want of water, the berries are small. I gathered the first ripe bunch on November 1st, and was pleased in finding it of so sweet and nice a flavour. This caused me some surprise, because the autumn in that part of England, though dry and sunny, was not hot, and east wind much prevailed. This being the case also in the south of England, and particularly about London, grapes, as I have been informed, did not ripen well out of doors, but were sour and poor. I am now desirous of investigating, during each succeeding year, whether this 'hot-house educated' vine will continue to bear fruit in the open air, and bring it to maturity, or not; and if it shall continue to ripen its berries, whether or not they will retain their sweetness of flavour. As the grapes now exhibited were cut nearly a month ago, they of course have become dry and shrivelled."

Mr. Middlemiss, Gardener to A. Pott, Esq., F.H.S., Bentham Hill, Tonbridge Wells, sent a fruit of the Dampsha Melon. He writes, "This variety is not so well known as its merits deserve. I do not send it with the idea of its being considered first-rate flavoured, but for its excellent property of keeping long after being cut. The fruit shown was cut on the 8th of September, and though it is now beginning to decay, it will show the length of time the variety will keep. It is a first-rate sort for every one, as it will even grow out of doors and ripen well. The plant from which the fruit sent was cut was planted in a cold frame after potatoes, and produced a splendid crop of well flavoured fruit."

Mr. Cameron, of Uckfield, furnished a dish of Mannington's Pearmain Apple, a good keeping sort, possessing a brisk flavour, and a great bearer. The specimens shown were stated to have grown on nursery trees, two years from the graft.

Potatoes, the produce of New Zealand seed which was distributed by the Society in April, 1849, were communicated by J. Gaskell, Esq., F.H.S., St. Nicholas. "The seed," that gentleman stated, "was sown in a shallow box, and placed in a forcing house. It came up the third day, was pricked out in small pots on the fifteenth, planted out in good soil (but without manure) in the first week of June, and dug up at Michaelmas. The plague-spot appeared on many. They were put away in a cool dry place. The following spring they were looked over, and with little exception they were diseased. The whole of them were planted, and about five-sixths grew; they were dug up at Michaelmas. The produce was one bushel, with scarcely four tubers bad. The present spring one row was planted; it was dug up at Michaelmas; three tubers were bad. The rest

were planted in a field by a young friend ; they were dug up at Michaelmas, and half of them were diseased."

A sample of a nice-looking dessert Pear, called Triomphe de Jodoigne, was furnished by Mr. Rivers, of Sawbridgeworth, from one of his potted plants.

From Mr. Lawrence, of Parliament-street, came common garden watering-pots, with globular roses, instead of those of the usual form. This is found to be an improvement, inasmuch as it disperses the water better and quicker than the old-fashioned rose.

III.—NOVELTIES FROM THE SOCIETY'S GARDEN.

Pompone Chrysanthemums, received from M. Van Houtte, of Ghent.

Accompanying these were some Pears, and the following Apples :—

Beachamwell.—Raised at Beachamwell, by the late John Motteux, Esq. It is a rich, brisk-flavoured dessert apple.

Court-pendu Plat.—From its late period of flowering, this is one of the few that completely escaped the frosts of last spring. It is a good bearer, and the habit of the tree is well adapted for dwarfs.

Blenheim Pippin.—This may be used either for table or in the kitchen. The tree is remarkably vigorous when young, and is then a shy bearer ; but it afterwards produces very abundantly.

Waltham Abbey Seedling.—A kitchen apple, melting when cooked, and of a clear pale amber colour, requiring very little sugar.

Tower of Glammis.—Another kitchen apple, solid and heavy, and a good bearer.

In consequence of a clerical error in the notice of the alteration of the By-Laws read at the last meeting, the following was re-read on this occasion as for the first time :—" It is proposed to repeal the following By-Law of the Society, viz. : Chap. 4, Art. 8, ' Every Fellow may at any time compound for all his future annual contributions by paying ten times the amount of his annual subscription ;' and to substitute the following words : ' Every Fellow may at any time compound for all his future annual contributions by paying, when first elected, 42*l.* ; at the end of seven years, 31*l.* 10*s.* ; at the end of fourteen years, 26*l.* 5*s.* ; at the end of twenty years, 21*l.*' "

IV.—BOOKS PRESENTED.

Flora Batava, Number 166. From his Majesty the King of Holland.
Smithsonian Contributions to Knowledge, Vol. II. ; and Proceedings of the American Association for the Advancement of Science. From the Smithsonian Institution.

PROCEEDINGS AT MEETINGS OF THE SOCIETY.

January 20, 1852. (Regent Street.)

I.—MEDALS AWARDED.

Banksian Medal:—

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a small collection of Orchids and other plants. It consisted of Dendrobium formosum, the variety of Zygopetalum crinitum called cæruleum, a good example of Cœlogyne cristata; the scarce Warrea Lindeniana, with two graceful spikes of spreading brown and white flowers; and two masses of Heliconia brasiliensis, exhibiting the real appearance which such plants present in their native country.

To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for a handsome smooth-leaved Cayenne Pine Apple, weighing 7 lbs. 8 oz.

Certificate of Merit:—

To Mr. Davis, of Oak Hill, East Barnet, for a dish of Oldaker's West's St. Peter's Grapes, plump and fine, and beautifully covered with bloom.

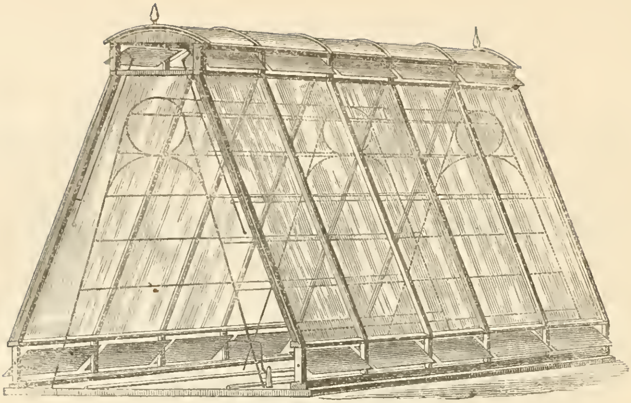
II.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Messrs. Loddiges furnished a promising new purple-flowered Dendrobe (*D. bigibbum*), obtained from the north-west coast of New Holland, and a white variety of Barkeria Skinneri.

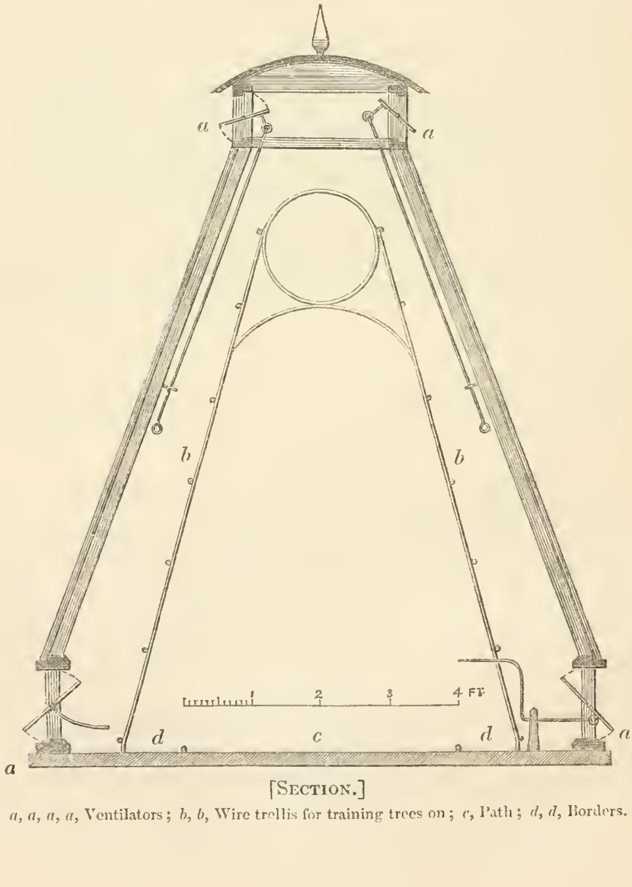
From Mr. Davis, of Oak Hill, East Barnet, came a small example of the Blood Pine Apple.

Twenty-four sorts of Seedling Potatoes were exhibited by Mr. Newton, of Brewer-street, Golden-square.

Mr. Spencer, Gardener to the Marquess of Lansdowne, F.H.S., at Bowood, sent a small model of a moveable span-roofed Glass-house, of the appearance and construction of which some idea may be gleaned from the annexed figures.



[PERSPECTIVE VIEW.]



[SECTION.]

a, a, a, a, Ventilators; *b, b*, Wire trellis for training trees on; *c*, Path; *d, d*, Borders.

Concerning this contrivance Mr. Spencer says :—"I think it will be a preferable structure (in several important particulars) to Mr. Ewing's newly invented glass walls for growing some kinds of fruits. The model in question is similar in some respects to the one proposed by Mr. Rivers in the Gardener's Chronicle, but I think it will be found an improvement so far as regards the ventilation at top and bottom. I should propose this kind of case or house to be placed due north and south, and the ends should be glass, particularly the south one; when glazed I propose placing strips of vulcanized Indian rubber under a bead that will be screwed down over the glass, which is laid flat on the rafters. It will be perceived that buildings of this description may very easily be taken down (the bars, &c., being numbered for the purpose), and the woodwork and glass packed away in a small space, and as easily refixed in spring, or when wanted. The size, or rather width, may likewise be increased for the growth of such things as vines and figs, requiring larger space for their leaves." Mr. Spencer adds :—"Since writing the above I have seen Mr. Rivers's opinion on glass walls. I think, with him, that they will prove expensive, while it must be admitted that they will not be a protection (regarded as a fence); and this will bring them to be considered merely as structures for growing fruits, when I feel confident that the simple and easily constructed houses which the model represents will have great advantages in more ways than one, part of which are—the ease with which they can be ventilated, cheapness of erection, and the facilities for training and managing the trees grown in them. The opening of the bottom ventilators, which all move at once, is imperfectly shown in the model. A wheel, with three or four cogs and a pulley or two, would be an improvement." It was observed that such a house would, no doubt, be found useful for many gardening purposes, but that it could not be compared with glass walls, on account of the dissimilarity of the purposes they were severally intended to answer.

Mr. Lawrence, of Parliament-street, sent a new description of Flower Stand.

III.—NOVELTIES FROM THE SOCIETY'S GARDEN.

Echeveria retusa.—A hardy greenhouse succulent, which was stated to be a very suitable plant for window gardens.

Along with it were examples of—

Beurré Rance Pear.—From a wall.

Reinette du Canada Apple.—In warm seasons this grows very large, and has a brisk Nonpareil flavour. It partakes of

the nature of the Reinettes Grises, but suits this climate better than they do. Notwithstanding the name it generally bears, it appears to be of European origin, for it has been long known in Portugal and in some parts of Normandy, and it was also introduced to the Society's collection, under the name of Mela Janurea, from the Ionian Islands. It answers both for kitchen and table.

Vale Mascal Pearmain.—A good bearer, and a yellowish-fleshed, brisk-flavoured table apple.

Rhode Island Greening.—One of the few American apples that succeed in this climate.

Pearson's Plate.—An excellent table variety; not equal to the Golden Harvey, but approaching it in point of quality, and a better bearer.

Dutch Mignonne.—Well known as an excellent bearer, and now very generally cultivated. It is suitable both for kitchen and table.

The Garden also supplied two sorts of Cardoon, an esculent which does not generally receive the attention which it deserves. They consisted of—

Cardon à côtes rouges.—A new variety, whose leaves are destitute of the usual sharp spines, or prickles, with which some others are furnished. The stalks have a reddish tinge, but they blanch whiter than those of any other kind.

Cardon de Tours.—Leaves prickly, stalks large and solid; a vigorous growing sort, and not so apt to run to flower as the old Spanish Cardoon is in dry summers.

These had been grown in trenches like celery, but it was stated that they require to have at least six inches deep of cow-dung in the bottom of the trenches. The plants were wound up with straw bands in October, and well banked up with earth, notwithstanding which they were considerably checked by the frequent sharp frosts which occurred last November.

The notice of alteration in the By-Laws, printed at p. xiv., was read a second time.

IV.—BOOKS PRESENTED.

Journal of the Royal Asiatic Society, Vol. XIII. Part 1, and Vol. XIV. Part 1. From the Society.
Journal of the Royal Geographical Society, Vol. XX. From the Society.
Journal of the Royal Agricultural Society, Vol. XII. Part 2. From the Society.
The Athenæum for December. From the Editor.
An Enquiry into M. Antoine d'Abbadie's Journey to Kaffa; On the Alluvia of Babylonia; and a Summary of the recent Nilotic Discovery. By Dr. Charles Beke. From the Author.
Le Bon Jardinier for 1852. From M. Vilmorin.
The Gardener's Magazine of Botany, New Series, Part 1. From the Publishers.

February 17, 1852. (Regent Street.)

I.—ELECTIONS.

Mrs. Villebois, Benham Park, Newbury; Henry D. Davis, Esq., Spring Grove, Hounslow; James Pateshall Jones, Esq., Turkey Street, Enfield; Gilbert Burns, Esq., Dublin; and Mr. T. B. Lawrence, 55, Parliament Street, London.

II.—MEDALS AWARDED.

Knightian Medal:—

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for an interesting collection of Orchids, consisting of Zygopetalum rostratum, Oncidium Cavendishii, and the handsome O. unguiculatum, a well coloured variety of Lycaste Skinneri, and L. tetragona (?), a good example of Ansellia africana, Cyrtochilum maculatum, and cut flower spikes of the charming Amherstia nobilis, which has been found to grow and flower so admirably at Ealing Park.

Banksian Medal:—

To Mr. Butcher, Gardener to W. Leaf, Esq., F.H.S., Streatham, for magnificent Cannon Hall Muscat Grapes, just beginning to shrivel, and distinguished by that fine violet tinge which is peculiar to this variety when produced in perfection.

To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for a Black Prince Pine Apple, weighing 5½lbs., and an Enville, weighing 4lbs. 13ozs.

Certificate of Merit:—

To Mr. Wooley, Gardener to H. B. Ker, Esq., Cheshunt, for a well cultivated Cypripedium insigne, bearing some 15 or 16 blossoms.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Messrs. Henderson, of Pine Apple Place, sent Araucaria Cookii, even a handsomer species than the Norfolk Island Pine itself; a pretty hybrid Begonia, with Franciscea confertiflora and eximia.

The Rev. F. Beadon, F.H.S., of North Stonham, furnished a boxful of striped Camellia flowers, gathered from a south wall,

where they had received no artificial protection whatever, in order to show what kind of weather is experienced in Hampshire. The blossoms were exceedingly fine, without speck or blemish. "I have counted," says Mr. Beadon, "this morning (Feb. 16) upwards of 400 buds and blossoms left on one tree; and I must add, that I have cut above 40 blossoms already. I have the Pompone, Striped, Waratah, Single Red, Double White, and one called Middlemiss's, I believe, all side by side, and doing well. The Striped is always the most forward, but the Pompone is generally in good bloom at the same time. My trees have been planted, some of them, 12 or 14 years, and are in the highest health."

The Hon. W. F. Strangways also sent examples of the mildness of the climate of Dorsetshire, in the shape of an exceedingly interesting collection of cut specimens of flowering shrubs and herbaceous plants, all grown out of doors at Abbotsbury. Among them were Hellebores, purple Rhododendrons, Azara integrifolia, with very pretty tufts of yellow flowers; Fuchsia splendens, finely in blossom; Pulmonarias, red and blue; Saxifraga ciliosa, the rare and beautiful Scorpion Iris (I. alata), the pretty Lithospermum rosmarinifolium, which is worth growing, even under glass, on account of its beautiful bright blue blossoms, and several other plants, all fully in flower. It was mentioned, with reference to the Scorpion Iris, that it refused to flower until it was planted within reach of the spray of the sea. Although it grew satisfactorily in a more inland situation, yet it would not blossom.

Mr. Epps, of Maidstone, sent a small piece of the white-flowered Cereus anguliger, and blossoms of the very fragrant Edgworthia chrysantha.

Three examples of one of the smaller kinds of Mandarin Orange were contributed by Mr. Fleming, from Trentham, where they are stated to be grown in pots, in late vineries, in which they ripen well, and are found to be highly ornamental, as well as useful for dessert.

Mr. Smith, Gardener to Mrs. Wray, of Wanstead, sent a model of a contrivance for protecting and accelerating the growth of early Peas, &c. It consisted of a small glazed frame, with a span roof, whose two sides were hinged at top so as to lift up and down in order to afford the means of ventilation. The ends were moveable, so that, if necessary, other frames might be added, with a view to increase the length of the protection. When not wanted for Peas, it was stated to be useful for striking cuttings under, as well as for many other purposes.

W. Everett, Esq., F.H.S., Chase House, Enfield, contributed examples of a new mode of glazing without the use of putty. He said, "I have long thought that this was a desideratum, from the constant expense I find in trying in vain to keep out the wet from my houses by the perishable article used at present; for unless the light is entirely reputtied, the new material will not join with the old, and a constant leakage takes place. It may be considered that the experiment remains to be tried. In reply, I have glazed in the manner proposed five lights on a pit, with very satisfactory results, and which have stood the test of fully six months. I have tried various ways; first, by putting putty under the glass (which is laid in grooves, ¼ of an inch deep), also with nothing under; but both these plans I have discarded, finding the glass apt to crack, from uneven pressure after putting in the cork upon the upper side. The lap plan I do not like, nor do I think it necessary with the 16oz. glass, which lies so flat that little air can get between. I have therefore from experiment found that placing a piece of thin cork under, and a thicker piece across, between each pane of glass, answers best, and is a saving of glass when no lap is required, with a far better appearance: indeed, my gardener says he sees an evident difference between the beans under the lights so glazed, over the lap system. It may be urged that the cost of cork would be an obstacle, but as far as I have tried my plan, the expense is very trifling, so much so as never to be a hinderance in adopting the plan. I have sent several specimens for inspection, both for garden use and also for sash windows for a dwelling house; the latter I think will find some approvers, for all persons may be their own glaziers, changing their panes of glass as often as they like, as the fixing is only by a few screws, and entirely within doors. In garden glazing, I press the glass into the cork that goes across; the glass is first laid in the grooves on the substratum of cork, and then a presser is used, fixed on the bottom of the frame, and force employed till the glass is driven into the cork firmly. The side pieces are afterwards introduced, which more firmly fixes the whole, and makes it impervious to wet. The cross pieces of cork, between the panes, are afterwards cut off above and below, and may be painted if more approved."

A Patent Garden Drill was shown by Mr. Hall, of Munster Nursery, Munster Square.

IV.—NOVELTIES FROM THE SOCIETY'S GARDEN.

Angræcum virens, which it is thought will turn out to be identical with A. eburneum.

Along with this came the following fruits :—

Ord Apple.—Esteemed by those who prefer a sharp juicy variety.

Lamb Abbey Pearmain.—A sound keeper.

Sweeny Nonpareil.—Tree bears very abundantly.

Federal Pearmain.—Keeps well without shrivelling.

Cuttings of the following Pears and Cherries were distributed :—

Beurré d'Amanlis.—This has been proved to be one of the best Autumn Pears; it is large and handsome, a good bearer, and well suited for this climate. It has recently obtained the following synonymes: *Wilhelmine; Poire Delbert,* or *d'Albert; Poire Hubard; Poire Kaissoise.*

The following are new, and reputed good sorts, but they have not yet been proved in the Garden :—

Bigarreau d'Esperen.—Cherry.—The tree is said to be an abundant bearer. Fruit large, pale, reddish next the sun, and of first-rate quality.

Bigarreau d'Octobre.—This is only recommended for its lateness; its name denotes its season of ripening, and no other sweet cherry is then to be had.

Josephine de Malines.—Pear.—Said to be middle-sized, obovate, melting, and excellent. Ripens in February, March, or April.

The proposed alteration in the By-laws, which was read at two previous meetings, was on this occasion read a third time. The Society then proceeded to ballot for the alteration, when twenty Fellows voted in the affirmative, and two in the negative. The old By-law was therefore declared to be repealed, and the new By-law passed.

V.—BOOKS PRESENTED.

The Quarterly Journal of the Geological Society, No. 29. From the Society.
The Athenæum for January. From the Editor.
Flora Batava, No. 167. From His Majesty the King of Holland.

March 2, 1852. (Regent Street.)

I.—ELECTIONS.

Lady D. Nevil, Dangstein, Petersfield; and R. Sneyd, Esq., Keele, Newcastle, Staffordshire.

II.—MEDALS AWARDED.

Knightian Medal:—

To Mr. Blake, gardener to J. H. Schröder, Esq., for a collection of Orchids, consisting of exceedingly well cultivated plants of Cœlogyne cristata, covered with flowers; Ansellia africana; the white-blossomed Dendrobium Heyneanum, perhaps in better condition than it had ever been seen in before; a fine plant of Epidendrum odoratissimum, and one of the higher coloured varieties of Lycaste Skinneri.

Banksian Medal:—

To Messrs. Standish and Noble, of Bagshot, who furnished on this occasion the first example of a new Sikkim Rhododendron in flower. It was named R. ciliatum, and is really very handsome, the flowers being blush, shaded on the outside with pink, very large for the size of the plant (which was scarcely 6 inches high), and well formed. The leaves were small, pale green, and covered with long hairs. It was mentioned that, owing to its dwarf habit and large blossoms, it would be valuable in the hands of the hybridist for dwarfing and giving a more desirable habit to some of our already existing kinds. The specimen sent had been forced; and therefore under out-door culture, if it should prove to be hardy, which is expected, the flowers will no doubt become deeper in colour. Messrs. Standish state that "the merits of this Rhododendron consist in its singular foliage, dwarf habit, and freeness to bloom. The seeds from which the plant in question was raised were sown on April 20th, 1850. From the following experiment it appears to be quite hardy. In the autumn of 1850 (with the exception of R. Dalhousiæ) we had samples of all the Sikkim Rhododendrons planted out in a cold frame. They were exposed by day to the open air, and covered up at night. One night, in February, 1851, they were left uncovered by mistake, and although in a small state (with the exception of R. argenteum) they withstood 10 deg. of frost without injury, and argenteum was only slightly

hurt, and recovered during the following summer. The White Tree Rhododendron, sown and treated as the above, suffered much the same as R. argenteum. Again, in September last we had a sharp frost which cut the young leaves of R. ponticum, while the Sikkims in the same bed were uninjured, and during last month they again withstood 16 deg. of frost without injury. Owing to its very dwarf and compact habit, together with its freeness of flowering, the species under notice will be very useful for many gardening purposes."

To Messrs. Jackson, for Maranta (?) sanguinea, a South American plant, which they have succeeded in flowering at Kingston for the first time in England. It requires a stove, and is valuable for its handsome foliage and, as it proves, for the beauty of its flowers.

Certificate of Merit:—

To Mr. Atkins, of Painswick, Gloucestershire, for a very handsome Cyclamen, the produce of a cross between C. persicum and C. Coum. It partook very much of the habit of the latter, while the flowers and leaves had the colour of persicum.

To Mr. Mitchell, of Brighton, for nice bunches of Black Hamburgh Grapes, just ripened.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Messrs. Rollisson sent a small but curious form of Cycnoches, (musciferum) which was apparently new to gardens. It was stated to have been purchased at one of Mr. Linden's sales.

Messrs. Hayes, of Edmonton, sent two single fringed seedling Chinese Primulas. One had handsome, large, bright rosy purple flowers; the other was chiefly remarkable for its stiff dwarf habit and disposition to curl, which was strikingly observable in the leaves.

From Messrs. Veitch came a flowering branch of Acacia dealbata, together with the following letter respecting it:—"Having seen in the Gardener's Chronicle of the 28th ult. an account of the Acacia dealbata flowering against an open wall at Enfield, we send a specimen in fine bloom, from a standard tree which grows in our private ground at Exeter. It stands on the grass, is upwards of 20 feet high, and from 18 to 20 feet through the middle, feathered to the ground, forming a beautiful compact tree, and covered with flowers similar to the specimen

sent. We have never given it any other shelter than a hayband twined round the stem for about 6 feet, as a precaution in case of very severe frost; it has been in its present situation about 8 or 10 years, and has never been injured in the least by the weather. It ought, perhaps, to be remarked that it had been planted against a wall four or five years previously to its being removed to its present situation."

A Ripley Queen Pine-apple, weighing 3 lbs. 3 ozs., was communicated by Mr. Jones, gardener to Sir J. Guest, Bart., F.H.S., Dowlais House, Glamorganshire.

"New yellow crowned" Seakale came from Mr. Prestoe, Gardener to E. W. Blunt, Esq., of Kempshall Park.

IV.—NOVELTIES FROM THE SOCIETY'S GARDEN.

An interesting example of the Nepal Ash-leaved Berberry (Berberis nepalensis). The main stem, in this instance, terminated in a cluster of six spikelets (each nearly 6 inches long) of fine dark yellow flowers, which, if it should fruit in this country, will be succeeded by beautiful purple oblong berries. The leaves are of a yellowish green, large, and very handsome; and if the plant should prove to be hardy, it will certainly be a very great acquisition to British gardens. It was mentioned that Mr. Fortune had met with a Berberry (not B. japonica) very much like it in China, and that another (the Acanthus-leaved Berberry) resembling it, but still very different, and probably handsomer, was to be found in the Neilgherries. This, which has round fruit (not oblong), may, however, be more tender than nepalensis, which comes from the more northern Himalayas. It was stated that persons in correspondence with the Madras Presidency could easily obtain fruit of the Acanthus-leaved Berberry from Ootacamund.

Cuttings of the following fruit trees were distributed:—

Reine Hortense Cherry.—Syn. Monstrueuse de Bavay, Lemercier, Belle de Laeken. It is said to have been found at the Carmelite Convent, at Vilvorde, in Belgium. Fruit very large, bright red, and of first-rate quality. Ripens in July.

Triomphe de Jodoigne Pear.—The tree is vigorous, and it is said to be an abundant bearer. Fruit very large, short pyriform, melting, and excellent, becoming fit for use in December.

The above are new sorts, that have not yet fruited in the Garden. The following are better known:—

Claygate Pearmain.—A first-rate apple for December and January, or even later. The flesh is yellowish, rich, and sugary, partaking of that Ribston pippin flavour which is so rarely found in apples.

Fifi Apple.—The cuttings of this have been presented to the Society by J. Disney, Esq., F.H.S., The Hyde, Ingatestone. It is a very handsome, middle-sized, round apple, of a fine pale yellow colour, with a delicate blush next the sun. It is likely to prove a good kitchen apple. The tree is a very abundant bearer: it is remarkable as a seedling of the Ribston pippin, without a trace of the colour, form, or quality of that variety.

V.—BOOKS PRESENTED.

Catalogo delle Piante che si coltivano nel Orto Botanico di Napoli; Catalogo delle Piante vendibili nel Orto Botanico di Napoli; Memoria della Macria; and Intorno all' Amygdalus Pumila del Linneo; by Professor Michael Tenore. From the Author.

March 16, 1852. (Regent Street.)

I.—ELECTION.

William Hunt, Esq., Pittincreef, Fifeshire.

II.—AWARDS.

Banksian Medal:—

To Mr. Meredith, Gardener to the Duke of Sutherland, F.H.S., at Cleifden, for an admirable specimen of a Hybrid Begonia, raised between B. manicata and hydrocotylifolia. It had the general aspect of the latter, but added the constitutional vigour and some other peculiarities belonging to manicata; while altogether it was a more desirable plant than either of its parents.

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for fine plants of the Hong Kong Enkianthus reticulatus, the charming Boronia triphylla covered with pink starry flowers, the white Eriostemon scabrum and Styphelia tubiflora.

To Mr. Ingram, Gardener to Her Majesty at Frogmore, for a Cayenne Pine Apple, weighing 7 lbs. 2 oz.

Certificate of Merit :—

To Messrs. Henderson, Pine Apple Place, for a beautiful specimen of Dielytra spectabilis, whose flowers were, however, somewhat deficient in colour, owing to their having been produced in too much heat. It was mentioned that a good way of having this useful Fumewort in perfection in early spring is to take plants from the open border, pot them, and bring them on in a cold house or frame, from which they can be transferred to the green-house, conservatory, or other suitable place to expand their blossoms in. After flowering they may be returned to the open border.

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for an interesting specimen of the Long-tailed Lady's Slipper (Cypripedium caudatum).

To Mr. Tillery, Gardener to the Duke of Portland, at Welbeck, for ripe fruit of the Japan Medlar (Eriobotrya Japonica), which was accompanied by the following remarks: "The fruit of this Medlar is much esteemed here, and coming in, as it does, at a time when other dessert fruit is scarce, makes it still more valuable. The tree from which the sample sent was taken has produced three or four dishes every week for the last six weeks, and there is still a considerable quantity to gather. The tree fills one entire house, which is devoted to its culture, and the following is the mode I find to be the best for successfully fruiting it. In the summer months, after the young growths are made, all the air that can possibly be given is supplied by taking off some of the lights of the house. At the flowering time, which is in September and October, the house is shut up, and a stove temperature maintained all the winter afterwards. The fruit begins to ripen by the beginning of February, on the early flowering clusters, and a regular succession is kept up for a long time. The flowers are deliciously sweet scented, and, along with magnificent foliage, the plant is well worthy of a place in any stove."

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Mr. Meredith sent from Cleifden a very fine plant of Begonia manicata, and a large and beautiful bouquet, with a view to illustrate a good mode of packing such things for travelling. Two parallel lines of string, about an inch apart, were fastened between the four opposite sides of a square wooden box so as to intersect each other in the middle; but at different levels. The shank of the bouquet was then passed down where the lines inter-

sect, embedded up to the flowers in damp moss, and tied firmly to the bottom of the box. In this way the bouquet is kept fast in one position and travels safely.

Messrs. Henderson, of Pine Apple Place, furnished Epacris hyacinthiflora candidissima ; a curious little deep yellow-flowered Acacia called squamata, with needle-like processes in the place of leaves ; and four plants of the Cape Lachenalia luteola.

From Messrs. Jackson, of Kingston, came two seedling Camellias, named Duchess of Buccleuch, and Martinii. The latter is a promising deep crimson-flowered kind, with a white stripe down the centre of each petal.

Mrs. Lawrence contributed Lycaste Skinneri, and cut flower spikes of Amherstia nobilis. It was mentioned that at Ealing Park the Amherstia is now as large as a good-sized apple-tree, that it has been in flower ever since Christmas; that nearly 170 spikes of its inflorescence have been cut from it; and that about as many more yet remain on the tree.

An example of the Sikkim Rhododendron ciliatum, of which a good specimen was shown at the last meeting by Messrs. Standish and Noble, was furnished by Sir Joseph Paxton, from Chatsworth. On this occasion it was quite colourless; but whether this was constitutional, or merely the effect of circumstances, could not in the present instance be clearly determined upon.

Mr. Ingram sent from Frogmore a pretty Epacris, a seedling from miniata.

IV.—NOVELTIES FROM THE SOCIETY'S GARDEN.

A very profuse-flowering pink Azalea sent from China by Mr. Fortune ; Rhododendron Nilagiricum, an exceedingly handsome kind, with round compact heads of bright rose-coloured flowers, that become paler as they get older ; and an interesting bush of Forsythia viridissima.

Cuttings of the following Pears and Apples were distributed :—

PEARS :

Jersey Gratioli.—Fruit of a good size, roundish ; the eye in a very even depression. Skin pale brown, somewhat rough, with russeted specks. Flesh melting, like honey, and exceedingly rich. Ripens in October. The tree is likely to prove an excellent bearer.

March Bergamot.—Of all the varieties of Pears raised by the late Mr. Knight, this ripens the latest. It was named the March

Bergamot from its keeping till March; but it will generally keep later; and it will succeed where the Belgian late pears, the Easter Beurré, and Beurré Rance, will not. The fruit resembles the Autumn Bergamot in form and size; skin yellowish-brown, partially russeted. Flesh buttery and rich.

Cerise de Spa.—This has not been fruited in the garden. It was received from Louis Van Houtte as a new sort. In M. Bavay's *Catalogue général des Pépinières Royales de Vilvorde*, near Brussels, the tree is described as being vigorous, and an abundant bearer. Fruit large, red, and of first-rate quality, ripening in July.

Millfield Apple. This appears to be a new sort, originally received by the Society from Messrs. Young, Nurserymen, Epsom. Fruit middle-sized, roundish, or somewhat pearmain shaped. Eye large, moderately deep. Skin greenish-yellow on the shaded side, reddish and obscurely streaked next the sun. Flesh yellowish and rich. In perfection in December and January.

V.—BOOKS PRESENTED.

Palms of British East India, by the late William Griffith, Esq.; from the Hon. the East India Company.

Proceedings of the Royal Society, Vol. VI. Nos. 83, 84, and 85; from the Society.

PROCEEDINGS AT MEETINGS OF THE SOCIETY.

April 6, 1852. (Regent Street.)

I.—ELECTIONS.

It was announced that the Council had recommended that H.R.H. Prince Albert and His Imperial Majesty the Emperor of Russia, now Fellows of the Society, should be nominated Honorary Members in two vacancies existing; whereupon H.R.H. Prince Albert and His Imperial Majesty the Emperor of Russia were balloted for, and duly elected Honorary Members of the Society.

II.—AWARDS.

Large Silver Medal:—

To Messrs. Veitch, for Phalænopsis Lobbii, a highly promising species, uniting the colour of P. rosea with the large blossoms of P. amabilis. The example exhibited was small, having been but recently imported, and only flowering for the first time: but it served to show what may be expected from larger and better established plants.

Knightian Medal:—

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a collection of Orchids, containing Dendrobium nobile, the Rhubarb-scented D. macrophyllum; a Maxillaria, labelled a variety of M. Harrisoniæ, but, probably, a different species, and much handsomer; the Brazilian Oncidium sarcodes, Trichopilia suavis, and Lycaste gigantea.

Banksian Medal:—

To Messrs. Henderson, of Pine Apple Place, for a collection of Hyacinths. The names of some of the best were: *Light blue*—Orondates, Robinson, Pasquin, Prince Frederick, Nimrod, Grande Vidette, Grand Lilac, Morello, and Passe tout (double). *Dark blue*—Laurens Koster (double), Prince Van Saxe Weimar, Amicus, Richard Cœur de Lion (very fine), Baron Van Thuyll, Charles Dickens, Prince

Oscar, and Mignonaude Drythout (double). *Violet*—Tubal Cain, William I., and Prince Albert. *White*—Helen, Grand Vainqueur, Le Tour d'Auvergne, La Vestale, Grande Vidette, Prima Donna, La Candeur, and A la Mode Epuisée (double, with a pink centre). *Blush*—Grandeur de Meneilles, Anna Maria (double), Triumph Blandina (ditto), and Tubiflora. *Plum*—L'Unique. *Yellow or buff*—Miss Kitty (double, very fine), Anna Paulowna, Heroine (double). *Deep rose*—Amphion. *Red*—Fireball, Mars, Herstelde Vreede, Appelius, Le Francq Van Berkhey, and Waterloo (double). *Light red*—La Dame du Laak, and Lord Wellington. Of these perhaps the most remarkable for general good properties was Richard Cœur de Lion, single blue, very similar in colour to Charles Dickens, Bleumorant, Prince Oscar, and Baron Van Thuyll, but infinitely surpassing them in quality ; tube smooth, as were the several divisions of it, glossy, broad, and of good size ; in truth the best of all the single varieties displayed on the occasion. Appelius and Fireball, single reds, were brighter in colour and better in form than Waterloo. Prince Frederick and Pasquin were the best of the double blues, and distinct ; Miss Kitty was conspicuous for its large bells, but they were rather thinly arranged on the spike. Prince Albert must still be considered one of the darkest Hyacinths in cultivation. These were all in ordinary shaped, rather small-sized pots, in each of which were two plants, and sometimes three, which made a very effective display.

To Messrs. Lane and Son, of Great Berkhampstead, for a collection of cut Roses, gathered from a house heated on the Polmaise principle. They consisted of some of the best of the Hybrid Perpetual, Bourbon, and Tea-scented kinds, as Apollon, Baronne Prevost, Chateaubriand, Cornet, Duchesse de Praslin. Duc d'Alençon, Duchess of Sutherland, William Jesse, Géant des Batailles, General Négrier, Madame Trudeaux, Soleil d'Austerlitz, Standard of Marengo, Armosa, Madame Angelina, Paul Joseph, Queen, Souvenir de la Malmaison, Mrs. Bosanquet, Belle Allemande, Comte de Paris, Moiré, Smith's Yellow, Vicomtesse Decazes, Fortune's Double Yellow, and others.

Certificate of Merit:—

To Mr. Turner, F.H.S., of the Royal Nursery, Slough, for six sorts of Pansies, in pots, consisting of Duke of Norfolk, Sir Philip Sidney, Disraeli, Ophir, Robert Burns, and Euphemia. These were exhibited to show the value of the

Pansy as an early blooming plant. They had been in flower about a month, and they were still covered with blossoms, which, under proper treatment, would continue to be produced till the end of May. They had been grown in a common 3-light box, from which the lights were removed during fine weather.

To Messrs. Veitch, for a Posoqueria (?) from the Organ mountains, possessing an elegant habit, and bearing quantities of long creamy white, peculiarly scented flowers.

To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for a smooth-leaved Cayenne Pine Apple, weighing 5¾ lbs.

To Mr. Allport, Gardener to H. Akroyd, Esq., Doddington Park, Nantwich, Cheshire, for a dish of black Hamburgh Grapes.

To Mr. Law, Gardener to E. J. Shirley, Esq., of Eatington Park, Stratford-on-Avon, for a dish of forced Peaches from trees growing in pots. They were quite ripe, but not very large or well coloured.

To Mr. M'Ewen, Gardener to the Duke of Norfolk, F.H.S., at Arundel, for five pots of Keens' Seedling Strawberry, and one of Alice Maude. They were loaded with large and well-ripened fruit. Concerning the kind of treatment they had received Mr. M'Ewen says:—" We begin putting the early runners in 3-inch pots about the middle of June, and not later than the middle of July. They are transferred as soon as rooted into the fruiting pots, which are well drained and filled with soil composed of three-fourths sandy loam and one-fourth decayed night-soil and leaf-mould. The pots are then placed on boards in an open square of the kitchen garden, and plunged in any light material. This prevents frequent watering; the plants are placed so thin that not a leaf of one touches another. When the pots are well filled with roots we water twice a week with liquid manure. In the winter the pots are placed on their sides so as to form a ridge. They are forced by introducing them for a few days into cold frames and pits, and they are *flowered*, *set*, and *swelled off* on a spare shelf at the very top of a fruiting pine pit, in a heat ranging from 70° to 75°, sometimes 20° more. To flavour them we place them in a cold frame, and in fine weather expose them fully for three or four days."

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

Messrs. Henderson sent a little tree of the Oleander-leaved Eriostemon, and a nice pyramidal plant of E. intermedia; also

the pretty Boronia triphylla; a variegated-leaved Coronilla glauca; Elæocarpus dentatus; a species of Aotus: and two dwarf, compact, free-flowering Rhododendrons.

Mr. Jones, Gardener to Sir J. Guest, Bart., F.H.S., furnished three Ripley Queen Pine Apples, weighing respectively 4 lbs. 2 oz., 3 lbs. 13 oz., and 3 lbs. 10 oz.

A plan for labelling Roses, the invention of Mr. Bohn, of York Street, Covent Garden, was brought under the notice of the meeting by the Rev. W. B. Hawkins, F.H.S. In a letter relating to these labels Mr. Hawkins says:—"Mr. Henry G. Bohn, the eminent publisher, of York Street, Covent Garden, and of North End House, Twickenham, who has paid considerable attention to horticulture, and particularly to the cultivation of roses, has written to me describing a mode of labelling these plants adopted by him in his garden, which appears so ingenious, and is at the same time so practicable and economical, that I think it should be brought before the notice of the Society. Mr. Bohn's plan is this: he uses a paper label, at one end of which is printed the name of the rose, and at the other end the colour and general description of the plant; this label is then folded in half and pasted back to back; it is then cast in a small flat tube of glass, closed at both ends, with a ring (in glass) at one end to hold the soft wire by which it is to be suspended from the plant. The following extract from Mr. Bohn's letter will perhaps afford a better explanation of his plan. He says, 'You seemed to think that the Society would like to see my plan of labelling Roses, and proposed to bring it to their notice at the next meeting. With that object I have the pleasure of sending you the first complete set of labels which has been received from the printer's, together with a sample of the mode of applying them. Glass tallies have been before the public for some time, but they did not answer well, as the lead or putty with which they were closed was pretty sure to drop out. Mine are the first, I believe, which are cast with the label inside, and though I now find plenty able to do it, I was told by several, when the idea occurred to me, that it could not be done. Having upwards of a thousand roses, printing the labels is to me a matter of economy as well as of convenience and neatness. The cost is not more than *five farthings* per label—paper, print, and glass included. As all who have seen the plan approve of it very much, and several growers intend to adopt it, especially for Orchids, I should be glad to have it seen previously by the Society.'"

Specimens of the label in its glass case were exhibited.

IV.—PLANTS, &c., FROM THE SOCIETY'S GARDEN.

The vivid crimson or rather scarlet Azalea obtusa, the Double White and Red flowering Chinese Peaches, two Californian Ceanothes, &c. &c.

V.—BOOKS PRESENTED.

Flora Batava, No. 168. From the King of Holland.
The Garden Companion for April. From the Publisher.

April 20, 1852. (Regent Street.)

I.—AWARDS.

Knightian Medal:—

To Messrs. Standish and Noble, for Azalea amœna, a new species collected in the North of China by Mr. Fortune, and expected to prove hardy in this country. It has small, rather blunt leaves, and very small round rosy-purple flowers, looking like so many half-inverted bells, so that, independent of its beauty, which is great, it will be exceedingly interesting on account of the form of its blossoms, which are quite distinct from those of any Azalea yet introduced.

To Messrs. Veitch, for Dendrobium albo-sanguineum.

To Messrs. Loddiges, for a collection of Orchids, consisting of Vanda suavis, Saccolabium ampullaceum, Lycaste Skinneri, Dendrobium anosmum, a species in the way of but handsomer than D. macrophyllum, and wanting the strong Rhubarb smell which belongs to the latter; Oncidium bifolium, Dendrobium chrysotoxum, Aerides affine, Lælia cinnabarina, and a white Angrec from Algoa Bay.

Banksian Medal:—

To Mr. Mylam, Gardener to S. Rucker, Esq., F.H.S., for a new Huntleya, marked with dark brown in the centre, which is surrounded by a field of pale primrose.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for Azalea Iveryana.

To Messrs. Henderson, of Pine Apple Place, for a handsome new Oxylobium.

To Messrs. Jackson, of Kingston, for a group of tender variegated plants, consisting of Vriesia speciosa (with two flower-

spikes), Dieffenbachia costata, Dracæna terminalis, the variegated Croton, Achimenes picta, and a few smaller plants.

Certificate of Merit :—

To Mr. Blake, Gardener to J. H. Schröder, Esq., F.H.S., for Dendrobium albo-sanguineum.

To Mr. Bunney, Nurseryman, Stratford, for Dendrobium Farmerii.

To Mr. Wood, of Norwood, for a specimen of the variety of Cape Heath called Hartnelli virens.

To Messrs. Henderson, of the Wellington Road Nursery, St. John's Wood, for a Continental Camellia named Rizzio, with two blooms on it, exhibiting the familiar sport of one flower being red while the other was white faintly striped with red.

To Mr. Forbes, Gardener to the Duke of Bedford, F.H.S., at Woburn, for four bunches of Black Hamburgh Grapes.

To Mr. Meredith, Gardener to the Duke of Sutherland, F.H.S., at Cliefden, for eight pots of Keens' Seedling Strawberry, in fruit, and a similar number of Cuthill's Black Prince, the latter being in 3-inch pots and well fruited.

To Mr. Lewis Solomon, of Covent Garden Market, for examples of Paris Cos and Grand Admirable Lettuces, imported from France. The attention of the meeting was drawn to the fact, that the only persons who in this country succeeded in producing fine Summer Lettuces at this season in England were two Dutch gardeners, one of whom was brought over by the late Mr. Labouchere.

II.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

A small piece of a flower-spike of the lovely Odontoglossum Pescatorei came from Mr. Mylam, Gardener to S. Rucker, Esq., F.H.S.

A Dendrobe from Sylhet, apparently D. heterocarpum in a diminutive state, was furnished by Messrs. Jackson, of Kingston.

Mr. Bunney contributed an imported plant of Dendrobium nobile.

From Messrs. Backhouse, of York, came a Cattleya, named amethystina, but which appeared to be a variety of C. intermedia. A Thysanotus, from New South Wales, accompanied it; but in the absence of bright light, its flowers did not open.

Mr. Ayres, of Blackheath, sent cut blooms of 24 varieties of fancy Pelargoniums.

R. T. Clarke, Esq., F.H.S., exhibited cut specimens of a white Chrysanthemum in bloom, which proves that this useful autumn flower may be had in blossom at almost any season, if such should be desired. It had of course been forced.

Messrs. E. G. Henderson sent a fancy Pelargonium named Annette; two small Orange-trees, in order to show how freely they bloom in pots in a small state; three Amaryllids, a collection of Cinerarias, four Cyclamens, and six hybrid Rhododendrons.

Some seedling Auriculas were shown by Mr. Coldham, of Southgate.

Mr. Sommersby, Gardener to Major Martyn, sent two dwarf Hydrangeas, and a white seedling Petunia.

From Messrs. Henderson came a new yellow-flowered Indian Dendrobe; a new Gastrolobium, the pretty Boronia tetrandra, the small growing free-flowering Eriostemon scabrum, and a species of Acacia.

Mr. Wood, of Norwood, sent a collection of variegated hardy plants and a seedling Rhododendron with bright crimson flowers.

A design for laying out ornamental grounds was shown by Messrs. Wood and Lake, land-surveyors, Lincoln's Inn Fields.

III.—PLANTS, &c., FROM THE SOCIETY'S GARDEN.

Rhynchospermum jasminoides, with white flowers as fragrant as those of a Jasmine, the Californian Ceanothus rigidus, exceedingly gay with numberless clusters of blue blossoms, &c. &c.

IV.—BOOKS PRESENTED.

The Athenæum for March. From the Editor.

May 1, 1852. (Regent Street.—Anniversary.)

The following Fellows of the Society were removed, viz.:—

The Duke of Northumberland,
The Bishop of Winchester,
J. Barchard, Esq.

The following were elected new Members of Council in their room. viz.:—

Sir Peter Pole, Bart.;
G. Rushout, Esq., M.P.;
R. S. Holford, Esq.

The following Fellows of the Society were elected Officers for the ensuing year, viz.:—

The Duke of Devonshire, President;
J. R. Gowen, Esq., Treasurer;
Dr. Royle, Secretary.
Mr. S. F. Gray, } Auditors.
Mr. G. Charlwood, }

The Annual Report from the Council and Auditors was read and adopted. (See the body of this volume.)

May 8, 1852. (Garden Exhibition.)

The weather on this occasion was propitious, and the exhibition everything that could possibly be desired; for not only were the plants produced admirable examples of cultivation, but they were furnished in such numbers that room under the tents could scarcely be found for them. Such Azaleas, Orchids, Roses, and Cape Heaths nobody ever saw in the Garden before; and, considering the season, there was a good show of fruit. The number of visitors was 2755, exclusive of exhibitors and persons officially employed.

I.—AWARDS.

The Large Gold Medal:—

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of twenty Stove and Greenhouse Plants.

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for twenty species of Exotic Orchids.

The Gold Knightian Medal:—

To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Speed, of Edmonton, for fifteen Stove and Greenhouse Plants.

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for six Stove and Greenhouse Plants, in 20-inch pots.

To Mr. Blake, Gardener to J. H. Schröder, Esq., F.H.S., for twenty species of Exotic Orchids.

The Gold Banksian Medal:—

To Messrs. Fraser, of Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for fifteen Stove and Greenhouse Plants.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for six Stove and Greenhouse Plants, in 20-inch pots.

To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for twenty species of Exotic Orchids.

To Messrs. Veitch and Son, of Exeter, for fifteen species of Exotic Orchids.

To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., at Sion, for ten species of the same.

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for twelve distinct varieties of Greenhouse Azaleas.

To the same for a collection of ten varieties of Cape Heath.

To Messrs. Rollisson, of Tooting, for the same.

To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for twelve varieties of Roses in pots.

To Mr. Francis, of Hertford, for the same.

To Mr. Turner, of Slough, for twelve varieties of Pelargonium, in 8-inch pots.

The Large Silver-gilt Medal:—

To Messrs. Pamplin, of Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Dods, Gardener to Sir John Cathcart, Bart., F.H.S., for fifteen Stove and Greenhouse Plants.

To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for six Stove and Greenhouse Plants, in 20-inch pots.

To the same for six species of Exotic Orchids.

To Mr. Over, Gardener to W. McMullen, Esq., of Clapham, for six Stove and Greenhouse Plants, in 13-inch pots.

To Messrs. Rollisson, for fifteen species of Exotic Orchids.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for ten species of Exotic Orchids.

To Mr. Chitty, Gardener to J. Basset, Esq., of Stamford Hill, for twelve distinct varieties of Greenhouse Azaleas.

To the same for twelve varieties of Roses in pots.

To Messrs. Rollisson, for six of the newer kinds of Greenhouse Azaleas in 8-inch pots.

To the same, for a collection of Miscellaneous Plants.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for six distinct varieties of Greenhouse Azaleas.

To the same for six varieties of Tall Cacti.

To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for a collection of Indian Rhododendrons.

To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for ten varieties of Cape Heath.

To Mr. Epps, of Maidstone, for the same.

To the same, for a collection of ten varieties of Cape Heath, in 11-inch pots.

To Mr. Watson, Gardener to Mrs. Tredwell, of St. John's Lodge, Norwood, for the same.

To Messrs. Lane, of Great Berkhampstead, for twelve varieties of Roses in pots.

To Messrs. Veitch and Son, for Hexacentris mysorensis.

To Mr. Dobson, of Isleworth, for twelve varieties of Pelargonium, in 8-inch pots.

To Mr. Bray, Gardener to Sir J. Goldsmid, Bart., F.H.S., for six varieties of Pelargonium, in 11-inch pots.

To Mr. Kempster, of Blackheath, for six varieties of Fancy Pelargonium, in 8-inch pots.

To Mr. Turner, of Slough, for the same.

The Certificate of Excellence :—

To Mr. Laybank, Gardener to T. Maudslay, Esq., of Knight's Hill, Norwood, for a collection of fifteen Stove and Greenhouse Plants.

To Messrs. Rollisson, for six Stove and Greenhouse Plants, in 13-inch pots.

To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of Helichrysums.

To the same, for six varieties of Cape Heath, in 8-inch pots.

To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for ten species of Exotic Orchids.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for six species of Exotic Orchids.

To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for six of the newer kinds of Greenhouse Azalea, in 8-inch pots.

To Messrs. Fraser, for six distinct varieties of Greenhouse Azaleas.

To the same, for ten varieties of Cape Heath.

To Messrs. Veitch, for a single specimen of Medinilla magnifica.

To Messrs. Lane, for a collection of Indian Rhododendrons.

To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for a collection of Miscellaneous Plants.

To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for ten varieties of Cape Heath.

To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for the same, in 11-inch pots.

To the same, for six varieties of Fancy Pelargonium, in 8-inch pots.

To A. Rowland, Esq., F.H.S., for twelve varieties of Roses in pots.

To Messrs. Paul, of Cheshunt, for the same.

To Messrs. Veitch, for a single specimen of Cattleya Mossiæ.

To the same, for a new species of Aerides from Moulmein.

To Mr. Gaines, of Battersea, for twelve varieties of Pelargonium, in 8-inch pots.

To Mr. Ayres, of Blackheath, for six varieties of Fancy Pelargonium, in 8-inch pots.

To Mr. Jarvis, Gardener to J. Ruck, Esq., of Croydon, for a Queen Pine Apple.

To Mr. Davis, Gardener to Lord Boston, F.H.S., for a Providence Pine Apple.

To Mr. Jackson, Gardener to G. Beaufoy, Esq., of South Lambeth, for Dutch Sweetwater Grapes.

To Mr. Dods, Gardener to Sir John Cathcart, Bart., F.H.S., for Black Hamburgh Grapes.

To Mr. Davis, of Oak Hill, for the same.

The Large Silver Medal:—

To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of fifteen Stove and Greenhouse Plants.

To the same, for six of the newer kinds of Greenhouse Azaleas, in 8-inch pots.

To Mr. Watson, Gardener to Mrs. Tredwell, of St. John's Lodge, Norwood, for six Stove and Greenhouse Plants, in 13-inch pots.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of Helichrysums.

To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a single specimen of Erica Hartnelli.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for six distinct varieties of Greenhouse Azaleas.

To Mr. Gaines, of Battersea, for a collection of Indian Rhododendrons.

To the same for six varieties of fancy Pelargonium in 8-inch pots.

To the same for six varieties of Calceolaria, in 8-inch pots.

To Mr. Jarvis, Gardener to J. Ruck, Esq., of Croydon, for ten varieties of Cape Heath, in 11-inch pots.

To Mr. Speed, of Edmonton, for six varieties of Cape Heath, in 8-inch pots.

To Mr. Parker, Gardener to J. M. Strachan, Esq., F.H.S., for a collection of Cape Pelargoniums.

To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for a single specimen of Phalænopsis grandiflora.

To Messrs. Standish and Noble, of Bagshot, for Azalea amœna.

To Messrs. Veitch, for Dendrobium clavatum.

To Mr. Bray, Gardener to E. Lousada, Esq., of Peak House, Sidmouth, for a Queen Pine Apple.

To Mr. Allport, Gardener to H. Akroyd, Esq., of Doddington Park, Nantwich, for Black Hamburgh Grapes.

To Mr. Spary, of Brighton, for the same.

To Mr. Davis, of Oak Hill, for Sweetwater Grapes.

The Silver Knightian Medal:—

To Mr. Chitty, Gardener to J. Basset, Esq., of Stamford Hill, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for six Stove and Greenhouse Plants, in 13-inch pots.

To Mr. Stuart, Gardener to T. Huggins, Esq., of Norwood, for a collection of Helichrysums.

To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for a single specimen of Erica Sindryana.

To Mr. Falconer, Gardener to A. Palmer, Esq., of Cheam, for six distinct varieties of Greenhouse Azaleas.

To Messrs. Veitch for Fitzroya patagonica.

To the same for Saxe-Gothæa conspicua.

To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for ten varieties of Cape Heath.

To Mr. Fairbairn, of Clapham, for the same.

To Mr. Hamp, Gardener to J. Thorne, Esq., of South Lambeth, for six varieties of Cape Heath, in 8-inch pots.

To Mr. Busby, Gardener to S. Crawley, Esq., F.H.S., for twelve varieties of Roses in pots.

To Mr. Watson, Gardener to Mrs. Tredwell, St. John's Lodge, Norwood, for a collection of Cape Pelargoniums.

To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a single specimen of Dendrobium nobile.

To Messrs. Veitch for Dendrobium albo-sanguineum.

To Messrs. Standish and Noble for Azalea vittata Fortuni.

To Mr. Westwood, of Acton Lane, for six varieties of Fancy Pelargonium, in 8-inch pots.

To Mr. Turner, of Slough, for twelve varieties of Pansies, in 8-inch pots.

To Mr. Lochner, of Warwick House, Paddington, for six varieties of Cineraria, in 8-inch pots.

To Mr. Forbes, Gardener to the Duke of Bedford, F.H.S., at Woburn Abbey, for Black Hamburgh Grapes.

To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for May Duke Cherries.

To Mr. Judd, Gardener to Earl Spencer, F.H.S., for British Queen Strawberries.

To Mr. May, Gardener to J. Watney, Esq., F.H.S., for Keens' Seedling Strawberries.

To Mr. Dew, of Ham Common, for Keens' Seedling Strawberries.

To Mr. Robertson, Gardener to Lady Emily Foley, Stoke Edith Park, Ledbury, for a Green-fleshed Melon.

The Silver Banksian Medal :—

To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of six Stove and Greenhouse Plants.

To Mr. Hamp, Gardener to J. Thorne, Esq., of South Lambeth, for a collection of Helichrysums.

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a single specimen of Eriostemon intermedium.

To Messrs. Lane, for six distinct varieties of Greenhouse Azaleas.

To Messrs. Veitch, for a Hardy hybrid Rhododendron, named Blanc Superbe.

To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for twelve varieties of Roses in pots.

To Messrs. Henderson, Pine Apple Place, for Tetratheca ericifolia.

To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., at Sion, for Oncidium sessile.

To the same, for a tree of Eriobotrya japonica in fruit.

To Mr. Lochner, of Warwick House, Paddington, for twelve varieties of Pansies in 8-inch pots.

To Messrs. E. G. Henderson, of St. John's Wood, for six varieties of Cineraria in 8-inch pots.

To Mr. Povey, Gardener to the Rev. J. Thorneycroft, F.H.S., for a Black Jamaica Pine Apple.

To Mr. M'Ewen, Gardener to the Duke of Norfolk, at Arundel, for British Queen Strawberries.

To the same, for Keens' Seedling Strawberries.

The Certificate of Merit :—

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for a single specimen of Leschenaultia Baxteri.

To Mr. Laybank, Gardener to T. Maudslay, Esq., of Norwood, for Erica Murrayana.

To Messrs. Henderson, Pine Apple Place, for Boronia tetrandra.

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a new species of Trichopilia.

To Messrs. Rollisson, for Ataccia cristata.

To Mr. Hally, of Blackheath, for a species of Libertia.

To Messrs. Veitch, for Streptocarpus biflorus.

To Mr. Terry, Gardener to Lady Puller, Youngsbury, Herts, for twelve varieties of Pansies in 8-inch pots.

To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for six varieties of Cineraria in 8-inch pots.

To Mr. Britten, of Lewisham, for British Queen Strawberries.

To Mr. Brewin, Gardener to R. Gunter, Esq., F.H.S., for Keens' Seedling Strawberries.

May 25, 1852. (Regent Street.)

I.—ELECTIONS.

Viscount Canning, 10, Grosvenor Square; Lady Shelley, Boscombe Lodge, Christchurch, Hants; Sir Thomas Parkins, Bart., Ruddington, Notts; George Miller, Esq., The Mall, Chiswick; Charles Leach, Esq., Clapham Park; Mr. Alexander Dancer, Fulham; John Murray, Esq., Strathisla Cottage, Bow Road; Albert Hamborough, Esq., Steep Hill, Isle of Wight; Herbert Barnard, Esq., 69, Portland Place and Park Gate, Ham Common; John Berners, Esq., Wolverston Park, Ipswich; Mr. Joseph Fairbairn, Clapham; and John Bradbury, Esq., Bedford House, Streatham. And as Foreign Members, the following, viz.:—His Excellency Prince Woronzow, Tiflis; his Excellency Count Francis Von Thun-Hohenstein, Tetschen Castle, Bohemia; Professor Alphonse de Candolle, Botanical Garden, Geneva; Professor Adrien de Jussieu, Museum of Natural History, Paris; Professor W. H. de Vriese, University of Leyden; Professor W. Gasparrini, Naples; Professor H. Mohl, Tübingen; and Professor Treviranus, Bonn.

II.—AWARDS.

Knightian Medal:—

To Messrs. Loddiges, for a collection of Orchids; but more especially for Aerides crispum, the purple variety of A. odo-

ratum, Sarcopodium Lobbii, and Cypripedium barbatum atropurpureum.

Certificate of Merit :—

To Mr. Floud, Gardener to C. Bailey, Esq., M.P., for a Providence Pine Apple, weighing 9 lbs.

To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for Murray Nectarines, well swelled and highly coloured.

To Mr. Reith, Gardener to Mrs. Smythe, F.H.S., for a dish of Royal George Peaches.

To Mr. Davis, of Oak Hill, East Barnet, for Black Hamburgh Grapes.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

J. Allnutt, Esq., of Clapham Common, furnished a large semi-double Azalea called Fulgens, and a hardy hybrid Rhododendron which he had found to flower well this year, while the blossoms of other hybrids of the same nature, associated with it, had been all killed by the cold winds and frosty nights of the late peculiar spring.

From Mr. Fleming came two examples of the Trentham Hybrid Melon, weighing respectively 2 lbs. 10 oz. and 3 lbs. 4 oz.

The true Bailey's Green-fleshed Melon, a round netted kind, weighing in this instance 5 lbs. 11 oz., was sent by Mr. Bailey, of Shardeloes Gardens, Amersham, who raised the variety from seed upwards of 20 years ago. It was stated by Mr. Bailey to be a finely flavoured variety.

Mr. Smith, of Mauchline, in Ayrshire, exhibited specimens of what he called a "transplant shade," which he expects will prove better than flower-pots for sheltering newly bedded-out plants, &c., from the heat of the sun in the day-time and from cold at nights. He says, "Observing in the gardens of the surrounding nobility and gentry that when plants are first transplanted out they are usually covered from the solar rays by means of flower-pots inverted over them and propped up on one side to admit the air, it struck me that this was at least not very craftsmanlike, and that it could not answer the purpose in the best possible way. I have made a model for an article intended to be formed of earthenware, and used for 'transplant shades.' It will be understood that these shades would be intended to stand on three short legs, so as to admit a fresh supply of air from all quarters, and that the other end is so contrived as to catch the quantity,

or nearly the quantity, of rain that would fall upon the space covered by the pot, and to conduct it upon the plant. In short, the advantages to be derived from my invention are—1. It will stand perpendicular in its natural position, no tilting being required. 2. By merely putting it gently on the ground, or by pressing it more or less into the ground, the supply of air can be either regulated or excluded altogether. 3. The concavity at the top will receive either rain or artificial watering, and shower it on the plant and soil without exposing the gardener to the trouble of removing the shades." Two models were shown, one without a top, the other with a top perforated with small holes and surrounded by a rim. The fault of the first was stated to be, that it permitted radiation from the soil at night to go on about as freely as if the plant was exposed; and that of the latter, that while it allowed water to pass through the top, it kept its inmate nearly as dark as under a common flower-pot. Instead of fixed perforated tops, or no top at all, it was suggested that moveable lids should be used, and then it was thought the contrivance might be an improvement on the common flower-pot for purposes of shading.

IV.—NOVELTIES FROM THE SOCIETY'S GARDEN.

A Diplacus raised from Californian seeds. It proves to be a very distinct and handsome kind, with large showy buff flowers shaded with salmon.

The following proposed alteration in the by-laws was read a first time:—"The Council hereby give notice that they propose to substitute for Chapter 8, Article 1, of the present by-laws, namely, 'The number of honorary members shall not at any time exceed five,' the following words:—'The number of honorary members shall not at any time exceed ten.'"

V.—BOOKS PRESENTED.

The Quarterly Journal of the Geological Society, No. 30. From the Society.
The Garden Companion for May. From the Publishers.
Transactions of the Zoological Society, Vol. IV. Part 2. From the Society.
Bombay Meteorological Observations for 1847, and Singapore Meteorological Observations for 1841–1845. From the Hon. the Court of Directors of the East India Company.

June 12, 1852. (Garden Exhibition.)

This was universally admitted to be one of the best Midsummer fêtes which has ever been held under the auspices of the Society. Plants displaying the most perfect cultivation were furnished in the greatest profusion and variety; and fruit was plentiful and

good. The weather was dry, but sunless and cold. At 6 o'clock A.M. the thermometer stood at 44°, and it had been at 40° two hours earlier; by noon the temperature had risen with difficulty 15°, and at 6 P.M. it was only 56°. The number of visitors was 4719, exclusive of exhibitors and persons officially employed.

The Large Gold Medal:—

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of twenty Stove and Greenhouse Plants.

To Mr. Blake, Gardener to J. H. Schröder, Esq., F.H.S., for twenty species of Exotic Orchids.

The Gold Knightian Medal:—

To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of fifteen Stove and Greenhouse Plants.

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for six Stove and Greenhouse Plants in 20-inch pots.

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for twenty species of Exotic Orchids.

The Gold Banksian Medal:—

To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for a collection of fifteen Stove and Greenhouse Plants.

To the same, for ten species of Exotic Orchids.

To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for six Stove and Greenhouse Plants in 20-inch pots.

To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for twenty species of Exotic Orchids.

To Messrs. Veitch, of Exeter, for fifteen species of Exotic Orchids.

To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for ten varieties of Cape Heath.

To Messrs. Rollisson, of Tooting, for the same.

To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for twelve varieties of Roses, in pots.

To Messrs. Lane, of Great Berkhampstead, for the same.

To Mr. Dobson, of Isleworth, for twelve varieties of Pelargonium in 8-inch pots.

The Large Silver-Gilt Medal:—

To Messrs. Fraser, of Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Dods, Gardener to Sir J. Cathcart, Bart., F.H.S., for a collection of fifteen Stove and Greenhouse Plants.

To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for a collection of six Stove and Greenhouse Plants in 13-inch pots.

To Messrs. Rollisson, for fifteen species of Exotic Orchids.

To the same, for a collection of Variegated Plants.

To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for ten species of Exotic Orchids.

To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., for six species of Exotic Orchids.

To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for six of the newer kinds of Greenhouse Azalea in 8-inch pots.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for six distinct varieties of Greenhouse Azalea.

To the same, for six varieties of Tall Cacti.

To A. Rowland, Esq., F.H.S., for twelve varieties of Roses in pots.

To Messrs. Paul, of Cheshunt, for the same.

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for ten varieties of Cape Heath.

To Mr. Fairbairn, of Clapham, for the same.

To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for ten varieties of Cape Heath in 11-inch pots.

To Mr. Epps, of Maidstone, for the same.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for a single specimen of Dendrobium moschatum.

To Messrs. Backhouse, of York, for Lælia purpurata.

To E. Lawrence, Esq., of Grove Terrace, Kentish Town, for twelve varieties of Pelargonium, in 8-inch pots.

To Mr. Turner, of Slough, for the same.

To the same, for six varieties of Fancy Pelargonium, in 8-inch pots.

To Mr. Parker, Gardener to J. M. Strachan, Esq., F.H.S., for six varieties of Pelargonium, in 11-inch pots.

To Mr. Westwood, of Acton Lane, for the same.

To Mr. Robinson, Gardener to J. Simpson, Esq., of Thames Bank, Pimlico, for six varieties of Fancy Pelargonium, in 8-inch pots.

The Certificate of Excellence:—

To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of twenty Stove and Greenhouse Plants.

To Mr. Speed, of Edmonton, for a collection of fifteen Stove and Greenhouse Plants.

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To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for a collection of six Stove and Greenhouse Plants, in 13-inch pots.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for six species of Exotic Orchids.

To Messrs. Veitch, for a collection of Helichrysums.

To the same, for a collection of Nepenthes.

To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for a collection of Hothouse Ferns.

To the same, for a similar exhibition produced in May.

To Mr. Bruce, Gardener to B. Miller, Esq., of Collier's Wood, Merton, for a single specimen of Erica Massoni.

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for six distinct varieties of Greenhouse Azalea.

To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for twelve varieties of Roses in pots.

To the same, for six varieties of Fancy Pelargonium, in 8-inch pots.

To Mr. Francis, of Hertford, for twelve varieties of Roses, in pots.

To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for ten varieties of Cape Heath.

To Messrs. Fraser, for the same.

To Mr. Watson, Gardener to Mrs. Tredwell, of St. John's Lodge, Norwood, for ten varieties of Cape Heath, in 11-inch pots.

To Mr. Clarke, of Streatham Place, Brixton, for the same.

To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for six varieties of Cape Heath, in 8-inch pots.

To Messrs. Standish and Noble, of Bagshot, for two new evergreen pinnated Chinese Berberries.

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a single specimen of Aerides odoratum.

To Mr. Westwood, of Acton Lane, for twelve varieties of Pelargonium in 8-inch pots.

To the same, for six varieties of Fancy Pelargonium, in 8-inch pots.

To Mr. Turner, of Slough, for six varieties of Pelargonium, in 11-inch pots.

To Mr. Constantine, Gardener to C. Mills, Esq., of Hillingdon, for six varieties of Calceolaria, in 8-inch pots.

To Mr. Gaines, of Battersea, for the same.

To Mr. Collinson, Gardener to the Marquess of Westminster, Eaton Hall, Cheshire, for a Queen Pine Apple, weighing 4 lbs. 4 oz.

To the same, for a Providence Pine Apple, weighing 10 lbs. 8 oz.

To Mr. Turnbull, Gardener to the Duke of Marlborough, at Blenheim, for a Smooth Cayenne Pine Apple, weighing 4 lbs. 11½ oz.

To Mr. Dods, Gardener to Sir J. Cathcart, Bart., F.H.S., for Black Hamburgh Grapes.

To Mr. Davis, of East Barnet, for the same.

To Mr. Lushey, Gardener to J. Hill, Esq., of the Rookery, Streatham Common, for Black Prince Grapes.

To Mr. Allport, Gardener to H. Arkroyd, Esq., of Doddington Park, Nantwich, for Muscat Grapes.

To Mr. Summerby, Gardener to Major Martin, of Fern Cottage, Windsor Forest, for White Frontignan Grapes.

The Large Silver Medal:—

To Messrs. Pamplin, of Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants.

To the same, for ten varieties of Cape Heath, in 11-inch pots.

To Mr. Laybank, Gardener to T. Maudslay, Esq., of Knight's Hill, Norwood, for a collection of six Stove and Greenhouse Plants, in 13-inch pots.

To the same, for ten varieties of Cape Heath.

To Mr. Dods, Gardener to Sir J. Cathcart, Bart., F.H.S., for six species of Exotic Orchids.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of Helichrysums.

To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for a single specimen of Hoya bella.

To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for a collection of Hothouse Ferns.

To the same, for a collection of Variegated Orchids.

To Mr. Pawley, of Bromley, for ten varieties of Cape Heath.

To Mr. Jarvis, Gardener to J. Ruck, Esq., of Croydon, for ten varieties of Cape Heath in 11-inch pots.

To Mr. Speed, of Edmonton, for six varieties of Cape Heath in 8-inch pots.

To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for twenty-five varieties of cut Roses.

To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., for two leaves of Victoria Regia.

To Mr. Ayres, of Blackheath, for six varieties of Fancy Pelargonium in 8-inch pots.

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for six varieties of Calceolaria in 8-inch pots.

To Mr. Draper, Gardener to the Bishop of Salisbury, for a Queen Pine Apple weighing 4 lbs. 1 oz.

To Mr. Davis, Gardener to Lord Boston, F.H.S , for a Providence Pine Apple weighing 8 lbs. 7 oz.
To Mr. Grienger, Gardener to S. Smith, Esq., F.H.S., for Black Hamburgh Grapes.
To Mr. Mitchell, of Kemp Town, Brighton, for the same.
To Mr. Martin, Gardener to Sir H. Fleetwood, Bart., F.H.S., for Black Prince Grapes.
To the same, for Black Frontignan Grapes.
To Mr. Smith, Gardener to S. Ricardo, Esq., of Titness Park, Sunning Hill, for White Muscadine Grapes.
To Mr. Harrison, of Oatlands Palace Gardens, Weybridge, for Muscat Grapes.
To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for six Royal George Peaches.
To the same, for six Murray Nectarines.

The Silver Knightian Medal:—

To Mr. Stuart, Gardener to T. Huggins, Esq., of Norwood, for a collection of six Stove and Greenhouse Plants in 13-inch pots.
To the same, for a collection of Helichrysums.
To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for six species of Exotic Orchids.
To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a single specimen of Erica Cavendishii.
To Messrs. Rollisson for Cissus discolor.
To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for a collection of Lycopods.
To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for ten varieties of Cape Heath, in 11-inch pots.
To Mr. Hamp, Gardener to J. Thorne, Esq., of South Lambeth, for six varieties of Cape Heath, in 8-inch pots.
To Mr. Parker, Gardener to J. M. Strachan, Esq., F.H.S., for six species of Cape Pelargonium.
To Mr. Cole, Gardener to H. Colyer, Esq., of Streatham, for a single specimen of Cattleya Mossiæ.
To Messrs. Backhouse, of York, for Cleisostoma? crassifolium.
To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for Lemons, Citrons, and Oranges.
To Mr. Bragg, of Slough, for twelve varieties of Pelargonium, in 8-inch pots.
To Mr. Gaines, of Battersea, for six varieties of Fancy Pelargonium, in 8-inch pots.
To Mr. Willmer, of Sunbury, for twelve varieties of Pinks, in 8-inch pots.

To the same for twenty-four varieties of Pinks in boxes.

To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for six varieties of Calceolaria, in 8-inch pots.

To Mr. Turner, of Slough, for twelve varieties of Pansies, in 8-inch pots.

To Mr. Jarvis, Gardener to J. Ruck, Esq., of Croydon, for a Queen Pine Apple, weighing 3 lbs. 9 oz.

To Mr. Davies, Gardener to J. Dixon, Esq., of Astle Park, Knutsford, Cheshire, for a Providence Pine Apple, weighing 8 lbs. 6 oz.

To Mr. Frost, Gardener to Lady Grenville, F.H.S., at Dropmore, for Black Hamburgh Grapes.

To Mr. Harrison, Gardener to M. Ricardo, Esq., F.H.S., for Black Prince Grapes.

To Mr. Rust, Gardener to J. Maclaren, Esq., F.H.S., for White Muscadine Grapes.

To Mr. Collinson, Gardener to the Marquess of Westminster, Eaton Hall, Cheshire, for six Royal George Peaches.

To the same, for an Egyptian Green-fleshed Melon.

To Mr. Tillyard, Gardener to Lord Southampton, F.H.S., for six Elruge Nectarines.

To Mr. Smith, of Twickenham, for British Queen Strawberries.

To the same, for the same variety in pots.

To Mr. Wortley, Gardener to Mrs. Maubert, of Norwood, for British Queen Strawberries.

The Silver Banksian Medal:—

To Mr. Hamp, Gardener to J. Thorne, Esq., of South Lambeth, for a collection of six Stove and Greenhouse Plants, in 13-inch pots.

To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of Helichrysums.

To Messrs. Veitch, for Rhododendron album grandiflorum.

To the same, for Streptocarpus biflorus.

To Mr. Stuart, Gardener to T. Huggins, Esq., of Norwood, for a collection of Lycopods.

To Mr. Turner, of Holloway, for twelve Alpine Plants.

To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for a single specimen of Erica Bergiana.

To Mr. Bragg, of Slough, for twelve varieties of Pansies, in 8-inch pots.

To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for White Muscadine Grapes.

To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for six Bellegarde Peaches.

To the same, for six Brugnon Nectarines.

To Mr. Bailey, Gardener to G. Harcourt, Esq., F.H.S., for six Brown Ischia Figs.

To Mr. Judd, Gardener to Earl Spencer, F.H.S., at Althorp, for British Queen Strawberries.

To Mr. Mann, of Mogden Lane, Isleworth, for the same.

To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for a Trentham Hybrid Melon.

To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a Hoosainee Scarlet-fleshed Melon.

The Certificate of Merit:—

To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a single specimen of Leschenaultia formosa.

To Mr. Turner, of Holloway, for a collection of British Orchids.

To Messrs. Standish and Noble, for Lilium sinicum.

To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for Hoya bella, var. Paxtoni.

To Messrs. E. G. Henderson, of Wellington Road, St. John's Wood, for a Seedling Hybrid Pelargonium.

To Mr. Braid, Gardener to H. Perkins, Esq., F.H.S., for six Brown Turkey Figs.

To Mr. Turnbull, Gardener to the Duke of Marlborough, at Blenheim, for British Queen Strawberries.

N.B.—Among Nurserymen who showed ten varieties of Cape Heath, Mr. Epps, of Maidstone, would have stood first if he had complied with the regulations.

The Judges much commended the Muscat Grapes exhibited by Mr. Turnbull, Gardener to the Duke of Marlborough, at Blenheim; but could award no prize in consequence of their unripeness.

June 22, 1852. (Regent Street.)

I.—ELECTIONS.

Lady Jane Walsh, Warfield Park, Bracknell, Berks. Charles Townley, Esq., Townley, Burnley, Lancashire. Lady Cooke, Wheatley, near Doncaster. John Sherborne Tench, Esq., The Wilderness, Hampton. — Bartlett, Esq., Banker, Buckingham.

II.—AWARDS.

Banksian Medal:—

To Messrs. Standish and Co., of Bagshot, for a new Clematis (lanuginosa), found in the north of China by Mr. Fortune. It resembles C. azurea, but it is different from that species, and will probably be hardier. The blossoms are large and handsome; but they were not seen under the best conditions, for the plant was small, and it had been forced into bloom somewhat prematurely. It was remarkable for the wool upon the back of the flowers and leaves.

Certificate of Merit:—

To Mr. Waterer, of Bagshot, for a deep purplish crimson Rhododendron called Celebrandum, with large heads of well-shaped flowers of good substance. It was stated to be a cross between R. maximum and altaclerense, and to be among the latest kinds known—a very important property, since it is thus secured against spring frosts.

To Mr. Jones, Gardener to Sir J. Guest, Bart., F.H.S., for a Ripley Queen Pine Apple, weighing 5 lbs. 3 oz.

To Mr. Chapman, Gardener to the Earl of Gainsborough, at Exton Park, Oakham, for two examples of a hybrid Melon, weighing respectively 3 lbs. 8 oz. and 4 lbs. 2 oz. It was stated to be a cross between the Trentham Hybrid and a small Melon called the Chinese Green-fleshed. It had something of the appearance of the Bromham Hall, and was found to be excellently flavoured.

III.—MISCELLANEOUS SUBJECTS OF EXHIBITION.

From Mr. Macintosh, Nurseryman, Stranraer-place, Maida Vale, came Cantua pyrifolia in bloom. It has fine glossy green leaves and pale lemon-coloured flowers, which are not, however, very striking.

A cut specimen of a seedling Pelargonium, resembling Luceum roseum, was shown by Mr. Middlewood, of Hornsey-road.

The Hon. W. F. Strangways contributed flowering branches of the following plants, which have been proved to be hardy at Abbotsbury, in Dorsetshire, viz., Veronica formosa, V. decussata, Melaleuca thymifolia, Echeveria secunda, Diplacus glutinosus, Epacris heteronema, Grevillea acanthifolia, Swammerdamia glomulifera. They were accompanied by Iris Monnieri, Gladiolus Segetum, and a piece of a branch, split in two and nearly 2 inches in diameter, of Callitris quadrivalvis, a Coniferous tree inhabiting the mountains of Barbary, where it is called the Arar

tree, and largely used for building purposes, it being remarkable for the durability of its wood.

From Mr. Martin, Gardener to Sir H. Fleetwood, Bart., Hill House, Windsor Forest, came Elruge Nectarines and Black Prince and Black Hamburgh Grapes.

Mr. Summerby, Gardener to Major Martyn, of Fern Cottage, Windsor, sent a specimen in a pot of what was considered by him to be a new kind of Vine. It proved, however, to be only the Alexandrian Ciotat, a variety remarkable for its singularly cut foliage, but seldom cultivated on account of its want of productiveness and inferior quality.

IV.—NOVELTIES FROM THE SOCIETY'S GARDEN.

Cut specimens, in bloom, of the Californian Cerasus ilicifolia, or evergreen Plum, which is now flowering in the Garden for the first time. Its blossoms resemble those of a Portugal Laurel, and they are said to be succeeded by fruit as large as a Sloe, and which is eatable; but it was mentioned that as it belongs to a suspicious family, a trial of its eatable quality must be made with caution.

The following proposed alteration in the by-laws was read a second time:—" The Council hereby give notice that they propose to substitute for Chapter 8, Article 1, of the present by-laws, namely, 'The number of honorary members shall not at any time exceed five,' the following words: 'The number of honorary members shall not at any time exceed ten.' "

V.—BOOKS PRESENTED.

Archives du Muséum d'Histoire Naturelle, Tome 5, Livraison 4, and Tome 6, Livraisons 1 and 2. From the Museum of Natural History, Paris.

The Garden Companion for June. From the Publishers.

The Athenæum for May. From the Editor.

PROCEEDINGS AT MEETINGS OF THE SOCIETY.

July 10, 1852. (Garden Exhibition.)

The number of visitors on this occasion, exclusive of exhibitors and persons officially employed, amounted to 8820. The weather was extremely propitious, permitting an inspection of the beautiful grounds of Chiswick House, thrown open to the meeting by the noble President of the Society, to be made under the most favourable circumstances. The exhibition, too, was excellent—in some respects, perhaps, the finest of the season. The fruit, as usual, formed the most remarkable feature.

I.—AWARDS.

The Large Gold Medal:—

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of twenty Stove and Greenhouse Plants.

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for twenty species of Exotic Orchids.

The Gold Knightian Medal:—

To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of fifteen Stove and Greenhouse Plants.

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of six Stove and Greenhouse Plants, in 20-inch pots.

To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for twenty species of Exotic Orchids.

The Gold Banksian Medal:—

To Messrs. Fraser, of Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Speed, of Edmonton, for a collection of fifteen Stove and Greenhouse Plants.

To Mr. Watson, Gardener to Mrs. Tredwell, of St. John's Lodge, Norwood, for a collection of six Stove and Greenhouse Plants, in 20-inch pots.

To Messrs. Rollisson, of Tooting, for fifteen species of Exotic Orchids.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for ten species of Exotic Orchids.

To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for ten varieties of Cape Heath.

To Mr. Epps, of Maidstone, for the same.

To Mr. Robinson, Gardener to J. Simpson, Esq., of Thames Bank, Pimlico, for twelve varieties of Pelargonium, in 8-inch pots.

To Mr. Turner, of Slough, for the same.

The Large Silver-Gilt Medal:—

To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of twenty Stove and Greenhouse Plants.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for a collection of fifteen Stove and Greenhouse Plants.

To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for a collection of six Stove and Greenhouse Plants, in 13-inch pots.

To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for ten species of Exotic Orchids.

To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., at Sion, for six species of Exotic Orchids.

To Messrs. Lee, of Hammersmith, for a collection of variegated Stove and Greenhouse Plants.

To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for ten varieties of Cape Heath.

To Messrs. Fraser, of Lea Bridge Road, for the same.

To Mr. Laybank, Gardener to T. Maudslay, Esq., of Norwood, for ten varieties of Cape Heath, in 11-inch pots.

To Mr. Clarke, of Streatham Place, Brixton, for the same.

To Mr. Stains, of Middlesex Place, New Road, for twelve varieties of Pelargonium, in 8-inch pots.

To Mr. Gaines, of Battersea, for the same.

To Mr. Bonham, Gardener to Mrs. Madderford, of Staines, for six varieties of Pelargonium, in 11-inch pots.

To Mr. Westwood, of Acton Lane, for the same.

To Mr. Miller, Gardener to R. Mosley, Esq., of Pine Apple Place, Maida Hill, for six varieties of Fancy Pelargonium, in 8-inch pots.

To Mr. Turner, of Slough, for the same.

The Certificate of Excellence:—

To Mr. Dods, Gardener to Sir J. Cathcart, Bart., F.H.S., for a collection of fifteen Stove and Greenhouse Plants.

To Mr. Watson, Gardener to Mrs. Tredwell, St. John's Lodge, Norwood, for a collection of six Stove and Greenhouse Plants, in 13-inch pots.

To the same, for ten varieties of Cape Heath, in 11-inch pots.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., for six species of Exotic Orchids.

To the same, for a collection of Helichrysums.

To Messrs. Rollisson, for six varieties of Achimenes.

To the same, for a collection of variegated Stove and Greenhouse Plants.

To the same, for ten varieties of Cape Heath.

To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for a collection of Hothouse Ferns.

To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for a single specimen of Erica retorta major.

To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for Medinilla Sieboldi.

To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for ten varieties of Cape Heath.

To Messrs. Pamplin, for ten varieties of Cape Heath, in 11-inch pots.

To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for six varieties of Cape Heath in 8-inch pots.

To the same, for Muscat Grapes.

To Mr. Pestridge, Gardener to W. Newnham, Esq., of Englefield Green, Egham, for six varieties of Fuchsia.

To Messrs. Paul, of Cheshunt, for fifty varieties of cut Roses.

To Mr. Parker, Gardener to J. M. Strachan, Esq., F.H.S., for twelve varieties of Pelargonium, in 8-inch pots.

To the same, for six varieties of Pelargonium, in 11-inch pots.

To Mr. Westwood, of Acton Lane, for twelve varieties of Pelargonium, in 8-inch pots.

To Mr. Robinson, Gardener to J. Simpson, Esq., of Thames Bank, Pimlico, for six varieties of Fancy Pelargonium, in 8-inch pots.

To Mr. Gaines, of Battersea, for the same.

To Mrs. Conway, of Earl's Court, Brompton, for six varieties of Scarlet Pelargonium, in 8-inch pots.

To Mr. Jones, Gardener to Sir J. Guest, Bart., F.H.S., for a Queen Pine Apple, weighing 5 lbs. 1 oz.

To Mr. Dods, Gardener to Col. Baker, F.H.S., for a Prickly Cayenne Pine Apple, weighing 5 lbs. 14 oz.

To Mr. Turnbull, Gardener to the Duke of Marlborough, at Blenheim, for a Providence Pine Apple, weighing 6 lbs. 4 oz.

To Mr. Davis, of Oak Hill, for a Providence Pine Apple, weighing 7 lbs. 2 oz.

To Mr. Allport, Gardener to H. Akroyd, Esq., of Doddington Park, Nantwich, for Black Hamburgh Grapes.

To the same, for Black Frontignan Grapes.

To Mr. Lushey, Gardener to J. Hill, Esq., of Streatham, for Black Prince Grapes.

To Mr. Rust, Gardener to J. Maclaren, Esq., F.H.S., for White Muscadine Grapes.

The Large Silver Medal:—

To Messrs. Pamplin, of Lea Bridge Road, Essex, for a collection of fifteen Stove and Greenhouse Plants.

To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for a collection of six Stove and Greenhouse Plants, in 13-inch pots.

To Mr. Godfrey, Gardener to J. Lister, Esq., of Tottenham, for six varieties of Achimenes.

To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of Helichrysums.

To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for six varieties of Kalosanths.

To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for a collection of Hothouse Ferns.

To Messrs. Henderson, of Pine Apple Place, for a collection of variegated Stove and Greenhouse Plants.

To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a single specimen of Erica Savileana.

To Messrs. Veitch, of Exeter, for Dracæna indivisa.

To Messrs. Standish and Noble, of Bagshot, for Abies Jezoensis.

To Mr. Fairbairn, of Clapham, for ten varieties of Cape Heath.

To Mr. Jarvis, Gardener to J. Buck, Esq., of Croydon, for ten varieties of Cape Heath, in 11-inch pots.

To Mr. Speed, of Edmonton, for six varieties of Cape Heath, in 8-inch pots.

To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for six varieties of Fuchsia.

To Mr. Parker, Gardener to J. M. Strachan, Esq., F.H.S., for six species of Cape Pelargonium.

To Messrs. Lane, of Great Berkhampstead, for fifty varieties of cut Roses.

To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for twenty-five varieties of cut Roses.

To Mr. Stains, of Middlesex Place, New Road, for six varieties of Fancy Pelargonium, in 8-inch pots.

To Mr. Westwood, of Acton Lane, for the same.

To Mr. Salter, of Hammersmith, for six varieties of Scarlet Pelargonium, in 8-inch pots.

To Mr. Bray, Gardener to E. Lousada, Esq., of Peak House, Sidmouth, Devon, for a Queen Pine Apple, weighing 4 lbs. 12 oz.

To the same, for an Enville Pine Apple, weighing 7 lbs. 10 oz.

To Mr. Price, Gardener to W. Thompson, Esq., for a Providence Pine Apple, weighing 6 lbs.

To Mr. Butcher, Gardener to W. Leaf, Esq., F.H.S., for Black Hamburgh Grapes.

To Mr. Harrison, of Oatlands Palace Gardens, Weybridge, for the same.

To Mr. Martin, Gardener to Sir H. Fleetwood, Bart., F.H.S., for Black Prince Grapes.

To Mr. Tillyard, Gardener to Lord Southampton, F.H.S., for White Muscadine Grapes.

To the same, for six Elruge Nectarines.

To Mr. Turnbull, Gardener to the Duke of Marlborough, at Blenheim, for Muscat Grapes.

To Mr. Campbell, Gardener to J. B. Pease, Esq., of North Lodge, Darlington, for White Frontignan Grapes.

To Mr. Brown, Gardener to W. C. Cartwright, Esq., of Aynhoe Park, Northamptonshire, for six Peaches.

To Mr. Davis, of Oak Hill, for six Elruge Nectarines.

The Silver Knightian Medal:—

To Mr. Hamp, Gardener to J. Thorne, Esq., of South Lambeth, for a collection of six Stove and Greenhouse Plants, in 13-inch pots.

To Mr. Godfrey, Gardener to R. Dawson, Esq., of Tottenham, for six varieties of Achimenes.

To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., at Sion, for Nelumbium speciosum.

To the same, for a set of Miscellaneous Plants.

To the same, for Black Hamburgh Grapes.

To Mr. Turner, of Holloway, for twelve Alpines.

To Mr. Constantine, Gardener to C. Mills, Esq., of Hillingdon, for a single specimen of Lisianthus Russellianus.

To Messrs. Henderson, of Pine Apple Place, for Araucaria Cookii.

To Messrs. Standish and Noble, of Bagshot, for Cephalotaxus Fortuni.

To Mr. Roser, Gardener to J. Bradbury, Esq., F.H.S., for six varieties of Cape Heath, in 8-inch pots.

To Messrs. Fraser, for six varieties of Fuchsia.

To Mr. Watson, Gardener to Mrs. Tredwell, of St. John's Lodge, Norwood, for six species of Cape Pelargonium.
To Mr. Francis, of Hertford, for fifty varieties of cut Roses.
To A. Rowland, Esq., F.H.S., for twenty-five varieties of cut Roses.
To Mr. Bragg, of Slough, for twelve varieties of Pelargonium, in 8-inch pots.
To Mr. Turner, of Slough, for twenty-four varieties of Pinks in boxes.
To Mr. Forbes, Gardener to the Duke of Bedford, F.H.S., at Woburn, for a Queen Pine Apple, weighing 4 lbs. 4 oz.
To Mr. Eaden, of New Road, Shacklewell, for Black Hamburgh Grapes.
To Mr. Turnbull, Gardener to the Duke of Marlborough at Blenheim, for Black Prince Grapes.
To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for White Muscadine Grapes.
To Mr. Henderson, Gardener to Sir G. Beaumont, Bart., for Grizzly Frontignan Grapes.
To Mr. Snow, Gardener to the Earl de Grey, F.H.S., for six Violette Hâtive Peaches.
To the same, for Black Tartarian Cherries.
To the same, for Elton Cherries.
To Mr. Collinson, Gardener to the Marquess of Westminster, at Eaton Hall, Cheshire, for six Elruge Nectarines.
To the same, for an Egyptian Green Fleshed Melon.
To Mr. Meyers, of Brentford, for Black Tartarian Cherries.
To Mr. Marcham, Gardener to J. Smith, Esq., F.H.S., for British Queen Strawberries.
To Mr. Beach, Sen., of Isleworth, for British Queen Strawberries.
To Mr. Beach, Jun., for British Queen Strawberries, in pots.
To Mr. Lydiard, of Bath Easton, Bath, for a Victory of Bath Melon.
To Mr. Gadd, of Bletchworth Castle, Dorking, for George the Fourth's Scarlet-fleshed Melon.

The Silver Banksian Medal:—

To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for six varieties of Achimenes.
To Messrs. Pamplin, for Erica obbata umbellata.
To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for a set of miscellaneous plants.
To Messrs. Fraser, for a single specimen of Kalosanthes coccinea.
To Messrs. Lane, of Great Berkhampstead, for Achimenes Margarettæ.

To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., at Sion, for specimens of Vanilla fruit.

To Mr. Over, Gardener to W. M'Mullen, Esq., of Norwood, for six varieties of Cape Heath, in 8-inch pots.

To Mr. Bray, Gardener to Baron Goldsmid, F.H.S., for six varieties of Fuchsia.

To S. Bennett, Esq., of Bath, for twenty-five varieties of cut Roses.

To Mr. Hunt, of Sale Street, Paddington, for twelve varieties of Pelargonium, in 8-inch pots.

To Mr. Baker, of Woolwich, for twenty-four varieties of Pinks in boxes.

To Mr. Bragg, of Slough, for the same.

To Mr. Mitchell, Gardener to St. J. C. Charlton, Esq., of Apley Castle, Salop, for White Muscadine Grapes.

To Mr. Eastham, Gardener to A. Toy, Esq., of Acton, for six Noblesse Peaches.

To Mr. Brown, Gardener to W. C. Cartwright, Esq., of Aynhoe Park, Northamptonshire, for six Nectarines.

To Mr. Judd, Gardener to Earl Spencer, K.G., F.H.S., for White Genoa and Marseilles Figs.

To Mr. Gainsford, of Brentford, for Black Tartarian Cherries.

To Mr. Hargen, Gardener to R. W. Edgell, Esq., of Milton Place, Egham, for British Queen Strawberries.

To Mr. Lack, of Turnham Green, for the same.

To Mr. Grant, Gardener to G. H. Sims, Esq., of Bathwick Hill, near Bath, for a Victory of Bath Melon.

The Certificate of Merit:—

To Mr. Munro, Gardener to the Earl of Clarendon, the Grove, Watford, for six varieties of Achimenes.

To Messrs. Henderson, of Pine Apple Place, for Phlox Mayii variegata and P. Thompsoni.

To Mr. Ivison, Gardener to the Duke of Northumberland, F.H.S., at Sion, for a single specimen of Erica metulæflora bicolor.

To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for Epidendrum sp. nova.

To Messrs. Rollisson, for Æchmea miniata.

To Messrs. Veitch, for Collinsia bartsiæfolia.

To the same, for Leptosiphon sp. nova.

To Mr. Jones, of Brentford, for Black Tartarian Cherries.

To Mr. Elliott, Gardener to Mrs. Boothby, of Twyford Abbey, Acton, for British Queen Strawberries.

To Mr. Lydiard, of Bath Easton, Bath, for the same.

July 20, 1852. (Regent Street.)

In consequence of a sufficient number of Fellows not being present on this occasion, a quorum was not formed. The following subjects were, however, presented for exhibition :—

Mr. Glendinning, F.H.S., sent a collection of Gloxinias, consisting of Teuchlerii, Wortleyana, Maria Van Houtte, Mrs. Griffiths, Rubra, Grandiflora, Baron Rozel, and the following new kinds: Albert Courtin, Souvenir de Bordeaux, Newelliana, and Huntleyana.

Mrs. Lawrence, F.H.S., produced a handsomely flowered Epacris miniata, Saccolabium Blumei and another species, and the variety of Aerides suavissimum called flavidum.

Mr. Watson, gardener to Mrs. Tredwell, of St. John's Lodge, Norwood, had Clerodendron fœtidum.

Mr. Ingram, of the Royal Gardens, Frogmore, sent a very pretty hybrid Achimenes, with large handsome leaves and deep orange-scarlet flowers, lined up the centre of the petals with minute round black dots. It was stated to have been raised between A. oculata and A. picta. Bunches of the white Cornichon Grape, a large very fleshy variety, of second-rate value, also came from the same establishment. As this now exists in many collections of this country, it may be as well to explain that it is very difficult to ripen, acquiring perfect maturity only in the long hot summers of Sicily, and similar parts of the Mediterranean. When ripe it is bright amber-coloured.

Messrs. Veitch contributed 12 specimens of the early sweet-kernelled Kaisha Apricot, of which some account appeared in vol. iv., p. 189. It is by far the earliest Apricot of good quality in this country.

Mr. Fleming, gardener to the Duke of Sutherland, F.H.S., at Trentham, produced a beautiful Moscow Queen Pine-apple, weighing 5¼ lbs.

From Mr. Cuthill, of Denmark-hill, Camberwell, came examples of the Lapstone Kidney Potato, which, though a late sort, was nearly ripe. They had been treated according to the plan published in his pamphlet on the Potato.

Specimens of capital glass milk-pans, as cheap as any foreign ones, were furnished by Mr. Phillips, of Bishopsgate-street.

II.—NOVELTIES FROM THE SOCIETY'S GARDEN.

A Californian Lily, with small reflexed orange blossoms spotted with black and tinged at the ends of the petals with reddish brown.

Along with this also came examples of Neapolitan Cabbage and white Paris Cos Lettuces, two first-rate varieties which do not readily run to seed; and the Auvergne Pea, a prolific kind, easily distinguished by the curved form of its pods.